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ABSTRACT

One hundred forty students (mean age 17.5 years, mean full scale IQ 69.18, and mean reading grade level 3.61), in the Diversified Occupations Programs (Vermont) were investigated to determine whether the Nonreading Aptitude Test Battery (NATB) is a valid instrument for identifying occupational aptitudes of educable mentally retarded and low average students. Findings for six hypotheses indicated: (1) that a positive relationship existed between the number of occupational aptitude patterns (OAPs) obtained on the General Aptitude Test Battery (GATB) and the NATB; (2) that the mean number of OAPs identified by the NATB was significantly higher than the mean number of OAPs identified by the GATB; (3) that all aptitude scores (on both tests) except on clerical perception were significantly related to full scale IQ; (4) that there was no difference in relationship between verbal IQ and cognitive aptitude scores by students on both tests; (5) that there was a positive relationship between performance IQ and all aptitude measures of the GATB and NATB with the exception of the clerical perception and motor coordination measures; and (6) that there was a significant relationship on both tests between reading score measures and aptitude scores for intelligence, verbal ability, numerical ability, and motor coordination. The findings implied that counselors and placement officials for retarded and borderline students should seriously consider selecting the NATB over the GATB. (Included in appendixes are items such as descriptions of the tests, definitions of aptitudes measured by the tests, and statistical data.) (MC)

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IDENTIFYING A NONVERBAL APTITUDE MEASURE FOR USE IN COUNSELING SECONDARY LEVEL MENTALLY RETARDED PUPILS

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A Research Project sponsored by
the Vermont Department of Education
Division of Vocational Technical Education

and

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Dear Sirs;

The Vermont Department of Education has just completed an extensive research project entitled: Identifying a Nonverbal Aptitude Measure for Use in Counseling Secondary Level Mentally Retarded Pupils. The results of our work indicate that the Non-reading Aptitude Test Battery can provide valuable counseling information and should be seriously considered by counselors who are selecting testing information.

The topic of our research seems to be relevant at this time because there is increased emphasis on including handicapped and disadvantaged students in vocational training programs. We certainly hope that this document will be accepted by ERIC and believe that it will make a significant contribution to the field.

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CHAPTER I

ORIGIN OF THE STUDY

Introduction

More than six million people in the United States are mentally retarded. Of these, nine-tenths are capable of employment but have difficulty finding and holding jobs.[1] For this reason many public and private rehabilitation agencies have extended their services to retarded individuals who are seeking to enter our complex job market. Before specifying rehabilitative programs or procedures, an assessment of each client's vocational potential must be made. That is to say, the recognition of vocational potential leading to meaningful occupational training can play a vital role in enabling the retarded to engage in more productive work and to participate more fully in their communities as contributing citizens. It also appears that the training provided is often not in the

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[1] W. R. Phelps, "Attitudes Related to the Employment of Mentally Retarded," American Journal of Mental Deficiency, 1965, Vol. 69, pp. 575-585.

occupational areas offering the most advantageous employment possibilities to these individuals.[2]

Educators are faced with the challenge of identifying the interests and aptitudes of their students. Knowledge of the students' interests and aptitudes can assist the educator in providing appropriate training for them. The student's preparation for modern day life must also qualify him for playing his role as a citizen. The educable mentally retarded must be able to provide for himself or his family with gaining economic security. Although retarded individuals vary considerably in their mental capacity, most can be trained for many unskilled, semi-skilled, and service jobs in which abilities other than academic intelligence are most significant. More than 85 per cent of retarded persons of working age in 1963 (approximately 2.9 million people) had intelligence quotients between 50 and 70 and were still judged as capable of being trained for lower level occupations.[3]

The education and training of the educable mentally retarded has far reaching implications for public schools. Educators are attempting to determine how the schools can

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[2]Edmund C. Neuhaus, "Training the Mentally Retarded for Competitive Employment," Exceptional Children, (May 1967), p. 6.

[3]The President's Panel on Mental Retardation, U.S. Mental Retardation: A National Plan for a National Problem, (Washington, D.C., August 1963), p. 6.

best prepare students to become productive adult citizens of their communities. One of the most important areas of concern is preparation for a job, yet Wolfensberger has stated that one of the most spectacular failures in the field of mental retardation has been in vocational prediction.[4]

Most advocates of the mentally handicapped readily agree that I.Q. and academic achievement alone are inadequate predictors of occupational readiness or vocational success. In practice, however, I.Q. scores are often used as the major criterion for predicting vocational success simply because other validated measures are not readily available. Hellman and others feel that predictive instruments other than I.Q. should be used when making placement/employment decisions because the retarded so often out-perform any expectations derived solely from such measures as I.Q.[5] Gellman feels that predictive instruments other than I.Q. need to be used in decision-making for placement and employment.[6]

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[4]W. Wolfensberger, "Vocational Preparation and Occupation," Mental Retardation, (Chicago: Aldine, 1967).

[5]Gary M. Clark, Prevocational Evaluation in Work Study Programs: An Expanded View, (University of Illinois, Champaign, Illinois), p. 49.

[6]Ibid., p. 49.

Unfortunately attempts to assess the vocational aptitude of the educable mentally retarded (EMR) have been largely unsuccessful due to the limited verbal skills of the EMR's. To alleviate this problem of assessment, the United States Training and Employment Service, a division of the Department of Labor, developed and released a new vocational aptitude assessment instrument called the Nonreading Aptitude Test Battery (NATB).[7] The NATB is an adaption of the General Aptitude Test Battery (GATB) which has been used extensively for high school vocational guidance programs and in employment service counseling. Donald Super identified the GATB as "potentially the most useful instrument of individual (vocational) diagnosis which has been developed."[8]

Even so, in its present form the GATB is not appropriate for counseling individuals who are educationally disadvantaged.[9] This would imply that the GATB is not appropriate for use with the mentally retarded as they are among those labeled educationally disadvantaged.

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[7] R. C. Droege, W. Showler, S. Bemis, J. Hawk, "Development of a Nonreading Edition of the GATB," Measurement and Evaluation in Guidance, 1970, pp. 45-53.

[8] D. E. Super, "The Use of Multifactor Test Batteries in Guidance," Personnel & Guidance Journal, 1956, pp.152-164.

[9] R. C. Droege and J. Hawk, "A Factoral Investigation of Nonreading Aptitude Tests," Paper presented at the 78th annual Convention of the American Psychological Association, 1970, p. 2.

Droege and others in describing the development of the nonreading edition of the GATB, have concluded that on the basis of several item analysis and validation studies, a nonreading edition of the GATB is necessary for assessing vocational aptitude of mentally, culturally, and educationally disadvantaged individuals.[10] They indicate, moreover, that their research is only a first step in an effort to improve aptitude measurement for the disadvantaged including the educable mentally retarded. They plan to continue their research efforts to improve the NATB.

This study is an attempt to determine if the NATB is a reliable instrument for identifying occupational aptitude patterns of educable mentally retarded and borderline intelligence vocational educational students. In addition to this, the study includes an investigation of the relationship between reading comprehension scores as measured by the Peabody Individual Achievement Test and NATB, GATB scores. Similarly, a comparison is made between individual I.Q. scores and NATB, GATB scores. That is to say, this research has two principle objectives. The first is to determine if the Nonreading Aptitude Test Battery renders findings that correlate with other tests commonly used to assess achievement or potential for

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[10] Droege, Showler, Bemis, & Hawk, op. cit., p. 47.

achievement of students with learning handicaps. The second is to determine if the NATB identifies more OAP's for this population than the more widely known General Aptitude Test Battery.

Statement of the Problem

The purpose of this study is to determine whether the Nonreading Aptitude Test Battery can provide administratively useful information for occupational guidance and programming of Vermont's Diversified Occupations students.

Within the limitations of this study, answers to the following specific questions will be sought:

1) Does the NATB show construct validity for use with secondary educable mentally retarded students?

2) What is the relationship between retarded individuals' occupational aptitude patterns when administered both the GATB and NATB?

3) What is the relationship between the retarded individual's I.Q. and GATB and NATB scores?

4) What is the relationship between the retarded individual's reading comprehension levels and their GATB and NATB scores?

Importance of the Study

The number of jobs which have been available to the retarded is decreasing due to increased complexity of roles as a result of advances in technology. The large labor pool available has brought about keen competition for the less complex jobs which are remaining. Although most experts agree that the mentally retarded are capable of supporting themselves through gainful employment, these individuals often suffer higher rates of joblessness than do their counterparts of average intelligence.[11]

Determining who has a reasonable chance for vocational success within the population defined as educable mentally retarded is a difficult task. It requires considerable skill, knowledge, and study because special tools of selection and classification within this population have been slow in developing. The intelligence quotient remains the primary "standardized" tool even though cumulative research indicates that I.Q. scores do not differentiate success and failure groups when competitive employment is used as the criterion measure.[12]

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[11] J. A. Huddy, Jr., An Analysis of Occupational Aptitudes of Educable Mentally Retarded and Slow Learning Pupils in Relation to the General Aptitude Test Battery, (unpublished doctoral dissertaion, Syracuse University, 1968), p. 14.

[12] Richard Peterson and Edna Jones, Guide to Jobs for the Mentally Retarded, (American Institute for Research, Pittsburg, Penn., 1964), p. 7.

It is believed that the recognition of vocational aptitude and the provision of occupational training can play a vital role in enabling the retarded to emerge in more productive work and to participate more fully in their community as contributing citizens. The current practice in many EMR programs is to make subjective placements of students into vocational training programs or jobs which may or may not be commenserate with their occupational aptitudes. If the NATB can be demonstrated to be an effective measurement, then vocational counselors could use it as part of their criteria for determining placement in appropriate training programs.

The NATB was chosen for this study because it is intended for disadvantaged individuals who lack literacy skills to take conventional aptitude tests which demand relatively high level basic educational skills. In developing the NATB, the GATB was used as a model for the following reasons: (1) the GATB measures the most important vocationally significant aptitudes and (2) the GATB has been validated against occupational criteria, the norms providing a ready-made basis for interpreting scores on the NATB.[13] The GATB has come to be recognized as the

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[13]United States Department of Labor, Manual for the General Aptitude Test Battery, Section III: Development, (U.S. Government Printing Office, Washington, D.C.), p.355.

the best validated multiple aptitude test battery in existance for use in vocational guidance.[14]

If the NATB can be validated for educable mentally retarded, the variety of occupational choices available to them should be much more easily identified.

Definition of Terms

To facilitate the communication of ideas in the study, certain terms are singled out for clarification. These terms are listed below:

Mental retardation refers to significantly subaverage general intellectual functioning existing concurrently with deficits in adaptive behavior, and manifested during the developmental period.[15]

Borderline intelligence refers to individual(s) who function intellectually in the range of one to two standard deviations below the test mean (68-83 Stanford-Binet or 70-84 Wechsler); sometimes called slow learners.[16]

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[14] U. S. Department of Labor, Op. Cit., p. iii.

[15] Herbert J. Grossman, M.D. (Ed.), Manual on Terminology and Classification in Mental Retardation, American Association on Mental Deficiency, 1973 Revision.

[16] Ibid., p. 162.

Educable Mentally Retarded (EMR's) refers to individual(s) who function intellectually in the range of two to three standard deviations below the test mean. This range will be approximately 50 to 70 on the Stanford-Binet or Wechsler intelligence scales. They are expected to achieve academically between the third and sixth grade level by the time they leave high school. As adults, they are expected to be socially adequate and capable of unskilled or semi-skilled work.[17]

I.Q. Individualized intelligence tests assign I.Q. scores to each person tested. These scores may be used to compare how one individual scores in relation to others tested. The mean score for the Binet and Wechsler is 100 with a standard deviation of 17 for the Binet and 16 for the Wechsler.[18]

Reading comprehension is the facility to derive meaning from printed words.[19] The ability of the student to comprehend what is explicit in the material, to judge what is implied, and to draw inferences with reference to other situations.[20]

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[17]Halbert B. Robinson & Nancy M. Robinson, The Mentally Retarded Child, (McGraw Hill, Inc., 1965), p. 208.

[18]Wechsler, Manual for the Wechsler Intelligence Scale for Children, 1949, p. 19.

[19]Dunn & Markwardt, Manual for the Peabody Individual Achievement Test.

[20]Eric F. Gardner & others, Manual for the Stanford Achievement Test, High School Battery, (N.Y.: Harcourt, Brace & World, Inc., 1965), p. 8.

Occupational Aptitude Patterns (OAP's). The OAP's are occupational ability groups consisting of several occupations with similar requirements. The OAP designates the three most important aptitudes out of the nine aptitudes measured by the GATB and NATB that have proven necessary to perform in particular occupational areas. Further, it states the minimum or cutting scores one must attain on the subtests to be considered as having sufficient aptitude to perform in the designated occupational areas. There are 62 Occupational Patterns into which thousands of occupations are grouped according to similar aptitude requirements.[21]

Hypotheses

The following hypotheses will be tested based on data obtained from a sample population of educable mentally retarded and borderline intelligence students.

Hypothesis 1 - The number of Occupational Aptitude Patterns as determined by the General Aptitude Test Battery and the Non-reading Aptitude Test Battery will be positively related.

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[21] H. Eugene Wysong, "The Use of the GATB in Grades 9 & 10," Personnel & Guidance, Vol. 43, (January 1965), pp. 508-512.

Hypothesis 2 - The Nonreading Aptitude Test Battery will identify more Occupational Aptitude Patterns than the General Aptitude Test Battery.

Hypothesis 3 - Measured I.Q. will be positively related to the General Aptitude Test Battery scores and the Nonreading Aptitude Battery scores.

Hypothesis 4 - The verbal sub scores of the individualized I.Q. test will have a significantly higher relationship to the cognitive aptitude scores (G.V.S.N.) of the General Aptitude Test Battery than the cognitive aptitude scores of the Nonreading Aptitude Test Battery for the following scales (G.V.S.N.)

Hypothesis 5 - The performance sub scores on the individualized I.Q. test will be positively related to the Nonreading Aptitude Test Battery scores and the dexterity and perceptional scores of the General Aptitude Test Battery.

Hypothesis 6 - Measured reading comprehension will be positively related to both the General Aptitude Test Battery scores and the Nonreading Aptitude Test Battery.

Summary

This study will determine whether the Nonreading Aptitude Test Battery (NATB) can provide useful information for the vocational guidance and counseling of secondary age educable mentally retarded students. Research indicates that many educationally and culturally disadvantaged individuals have been unable to follow instructions and read and understand test items because the traditional tests required educational competencies. The NATB is designed to measure the vocational aptitude of individuals whose educational deficiencies prevent them from obtaining valid scores on tests which require higher literacy skills.

The research is an attempt to determine whether the NATB is a valid instrument for identifying occupational aptitudes of educable mentally retarded students. Within the limitations of the study a determination of the relationship between reading comprehension scores and GATB and NATB scores will be made. The relationship between I.Q. scores and scores on the GATB and NATB will also be determined.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

In this chapter a review of the literature pertinent to the study is made. The literature is grouped into the following categories:

1) mental retardates including the cultural background and employability of mental retardates.

2) identification of occupational aptitudes of the mentally retarded.

3) the use of the General Aptitude Test Battery and its predictability.

4) the use of the General Aptitude Test Battery and the Nonreading Aptitude Test Battery with mentally retarded students.

The Employable Mental Retardate

In 1963 the U. S. Department of Health, Education, and Welfare calculated that about 3.3 million of the estimated six million retarded Americans were of working

age.[1] Further, H.E.W. estimated that at least 2.9 million of this age group had intelligence quotients between 50 and 70 and were capable of being trained for numerous unskilled, semi-skilled, or service jobs in which abilities other than intelligence are significant.[2] Hence, they concluded that nearly 85% of the retarded population can acquire vocational skills and with special assistance can lead productive lives.

Not all retarded individuals, however, are capable of independent employment. At least 10% of the retarded population have I.Q.'s between 20 and 50 and are considered moderately retarded. These individuals usually remain permanently below the intellectual level of a seven year old child.[3] Increasingly, the moderately retarded remain in community settings, however, where many of them are able to benefit from sheltered employment. Seldom are these individuals found in the normal labor market.

Another 3% of the retarded population are labelled severely retarded.[4] Even as adults these individuals are unable to provide for their own needs and usually require institutional or respite care.

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[1] U. S. Department of Health, Education and Welfare, Mental Retardation: Activities of the U. S. Department of Health, Education and Welfare, July 1963, p. 6.

[2] Ibid., p. 6.

[3] Ibid., p. 6.

[4] Ibid., p. 7.

Studies on the Employability of the Mentally Retarded

Retarded adults found their way into the labor market long before services for preparing and placing them in employment were available. To attest to this fact, several studies conducted in the early 1900's reported fairly high employment rates among persons who had returned to the community from mental retardation programs.

The first historically significant study of previously institutionalized retarded persons was reported by Fernald in 1919. In this documentation, Fernald assessed and reported the adjustment of mentally retarded residents of the Waverly State School in Massachusetts who were discharged during the period 1890-1914.[5] His data consisted of correspondence, interviews with parents, friends, and others who had relevant information about these former residents. To his surprise, he found that a substantial number of these former residents married and became self-supporting. The data for males was noted to be very encouraging as they exhibited a relatively low incidence of anti-social behavior and a high incidence of good community adjustment. Among those employed, most worked in unskilled trades.

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[5] W. E. Fernald, "After-Care Study of Patients Discharged From Waverly Over a Period of 25 Years," Ungraded, Vol. 5, 1919, pp. 25-31.

A decade later, a study by Foley reported on the status of residents released from the Rome State School for the Retarded in Rome, New York.[6] Likewise, this investigation which spanned twenty years of follow-up, reported relatively few instances of anti-social behavior by former residents. Rather, a great majority of the former residents were both employed and self-supporting. In yet another investigation, Johnson reported finding successful community adjustment records among former residents of the Laconia State School in Laconia, New Hampshire.[7]

The employability of the mentally retarded is also evident in more recent studies. Masland stated that despite the stigma associated with special class placement, retarded students find employment and become self-supporting citizens after leaving school.[8] In fact, for three decades it has been reported that persons of limited mental abilities could participate in work in their communities. Recent studies also indicate that many retarded persons have sufficient aptitude to enable them to be successful in semi-skilled jobs as well as those classified as unskilled.

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[6] R. W. Foley, "A Study of Patients Discharged from the Rome State School for the Twenty-year Period Ending December 31, 1924," Journal of Psycho-Asthenics, Vol. 34, 1929, pp. 180-207.

[7] B. S. Johnson, "A Study of Cases Discharged from Laconia State School from July 1, 1924 to July 1, 1934," American Journal of Mental Deficiency, Vol. 50, 1946, pp. 437-445.

[8] R. L. Masland, "The Prevention of Mental Retardation: A Survey of Research," American Journal of Mental Deficiency, Vol. 62, 1958, pp. 991-1114.

To further substantiate the employability of the mentally retarded, Dinger[9] randomly sampled 144 former students of special classes for the educable mentally retarded in Altoona, Pennsylvania, and found that 42% of them had an annual income greater than the $3,600 received at that time by a beginning teacher in that state. In addition, he found that 65% of the males had been in the armed services. Primarily, the jobs of those sampled had been of the unskilled variety although a number of them advanced to semi-skilled jobs after being employed for awhile. Dinger concluded that adult retardates are capable of successful occupational adjustment to unskilled and semi-skilled jobs which have few academic requirements.[10]

In two follow-up studies of former educable mentally retarded students from the Kansas Work Study Project, Chaffin, Spellman, Regan and Davison concluded that most educable mentally retarded students would be employed in the competitive labor market without the benefits of a work study program.[11] Students who had participated in the work study program, however, held their jobs longer; and they

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[9]Jack C. Dinger, "Post-school Adjustment of Former Educable Retarded Pupils," Exceptional Children, Vol. 27, 1961, pp. 353-360.

[10]Ibid., p. 359.

[11]Jerry D. Chaffin, Charles R. Spellman, C. Edward Regan, Roxana Davison, "Two Follow-up Studies of Former Educable Mentally Retarded Students from the Kansas Work-Study Project," Exceptional Children, (Summer 1971), pp. 733-738.

earned more money than did the students from the comparison group. The results of this extensive study suggest that at least three fourths of the educable mentally retarded were capable of some kind of employment without the intensive vocational preparation purportedly inherent in cooperative work study arrangements. Chaffin also states that:

> It would appear that the goal of the work study program is not to make students employable; rather to enhance the employability which already exists for most of the students in the program. This can be carried out by developing deliberate work training programs in the skilled and semi-skilled occupations with a goal of increasing substantially the earning potential of the more capable educable mentally retarded students.[12]

It would appear from the results of follow-up studies that the mentally retarded definitely have a place in our nation's job market. The task of educators of retarded students is to identify particular job stations in which such students can function effectively. This entails two important tasks. First, the teacher thoroughly analyzes the skill requirements for any job stations considered appropriate for his students. Various task analysis procedures and instruments have been developed for this purpose. Next, the teacher measures student aptitudes compatible with the job requirements. In summary, then, the goal of vocational programs should be to enhance the employability

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[12]Chaffin, et al., p. 737.

of the retarded by providing training in areas where aptitude and potential exist.

Cultural Background of the EMR

The statistics on mental retardation and poor academic performance too often fail to distinguish between pseudo-mental retardation, attributable to the effects of poverty, and actual mental retardation caused by physiological defects. This is because the instruments used to measure one's I.Q. cannot differentiate between the mentally retarded and the culturally disadvantaged as both populations tend to score significantly below the mean on standardized tests.[13] When referring to standardized testing, Hurley states that:

> This approach does not in any way measure the intellectual potential of the poor child. It serves only to reinforce middle-class prejudice.[14]... Intellectual function and capacity cannot be divorced from psychological processes and cultural settings.[15]

Too often, measured intellectual differences which exist between disadvantaged poor and middle class children are indicative of a lack of a stimulating environment

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[13] Roger L. Hurley, Poverty and Mental Retardation: A Causal Relationship, (Random House, New York, N.Y., 1969) p. 29.

[14] Ibid., p. 29.

[15] Ibid., p. 30.

during the critical formative years. Too often poor or disadvantaged students do not reach the middle class standard of achievement because they are immersed in a culturally barren world. Orville Johnson points out that the majority of the mentally retarded population comes from lower class homes that provide a minimum of psychological, social, and cultural stimulation.[16]

In a study of socio-economic background of mentally retarded individuals, the President's Committee on Mental Retardation reported that the majority of the nation's mentally retarded individuals come from the socially and economically deprived backgrounds.[17] Among the nation's mentally retarded, three fourths of them are found in isolated and impoverished urban and rural slums.[18] The children of low income families often enter school without the prerequisite experiences or skills necessary for systematic learning. Thus, many become regarded as functionally retarded in language and in the ability to perform the abstract thinking which is required to read, write and count.

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[16]G. Orville Johnson, Education for the Slow Learners, (Prentice Hall, Inc., Englewood Cliffs, N.J., 1963).

[17]The President's Panel on Mental Retardation, A Proposed Program for National Action to Combat Mental Retardation, (October 1962) p. 11.

[18]President's Committee on Mental Retardation, The Edge of Change, (U.S. Government Printing Office, March 1968), p. 19.

Certain characteristics commonly attributed to families with retarded children are also characteristic of culturally disadvantaged families. Adverse social, economic, and cultural factors play a significant role in the causation of cultural and educational deprivation as well as mental retardation.[19] Many people purport that a causal relationship exists between mental retardation and cultural deprivation.[20]

Frank Reissman uses the term "culturally deprived" interchangeably with "educationally deprived" to refer to members of lower socio-economic groups who have had limited access to education.[21] Because of the commonalities existing between the mildly retarded and the culturally disadvantaged, it would seem logical that educational materials developed for one group would be applicable to the other. For example, the Nonreading Aptitude Test Battery was developed for use with individuals who lack the literary skills to take the General Aptitude Test Battery. They may be retarded or culturally disadvantaged; if they lack literary skills they should be tested with the NATB.

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[19]Frank Reissman, The Culturally Deprived Child, (Harper & Row, Publishers, New York, N.Y., 1962) p. 51.

[20]Allan Rabinoff, A Survey of Attitudes of Mothers With Mentally Retarded Children, University of Wisconsin, Milwaukee, Wisconsin, August 1968, pp. 11-17.

[21]Reissman, Op. Cit., p. 53.

Identifying Occupational Aptitudes

The first studies attempting to predict success in trade learning were made after World War I. These studies were concerned mainly with the importance of intelligence in the skill trades. Studies by Bird[22] and Cowdery[23] suggested from the beginning that intelligence as we measure it, was little related to success in certain types of vocational courses. Bird concluded that vocational classes offered an exceptional opportunity for those who were misfits in the traditional subjects.[24]

Ghiselli and Brown,[25] summarizing their studies on the effectiveness of intelligence tests in the selection of workers, found that for skilled workers there was a significant relationship between intelligence and success in the trade. In the semi-skilled and unskilled areas, however, they were unable to find a significant relationship between intelligence and job success. What Ghiselli and Brown noted had been previously reported by Abel who found that normal intelligence is necessary for skilled

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[22] V. H. Bird, "A Study of the Correlation of General Intelligence and Progress in Learning Machine Shop Work as Related to the Problems of Educational Guidance," Industrial Education Magazine, Vol. 24, 1922, pp. 67-69.

[23] K. M. Cowdery, "Measures of General Intelligence as Indices of Success in Trade Learning," Journal of Applied Psychology, 1920, p. 328.

[24] Bird, Op. Cit., p. 68.

[25] E. E. Ghiselli and C. W. Brown, " The Effectiveness of Intelligence Tests in the Selection of Workers," Journal of Applied Psychology, XXXII, 1948, p. 578.

jobs but less significant for semi-skilled and unskilled jobs.[26] Ghiselli and Brown found that for skilled workers, the median coefficient between I.Q. and job success was .55. This was derived from six studies. For semi-skilled workers, the median coefficient of forty-five studies was .20 with twenty-three of the coefficients not being significantly different from zero.[27] It is apparent, therefore, that the higher the skill level of the trade, the greater the relationship between intelligence and success in the trade.

In the field of aptitude testing, there is a trend toward batteries of tests based on factor analysis. The question arises as to whether these batteries are preferable to using combinations of the commonly used single tests. Guilford and Zimmerman emphasized the advantages of factor tests: a) wide coverage at economical costs, b) meaningfulness and dependability, c) adoption to batteries, d) enlightened selection of batteries.[28]

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[26]Theodore Abel, "Tested Mentality as Related to Success in Skilled Trade Training," Archives of Psychology, Vol. 77, 1925.

[27]Ghiselli and Brown, Op. Cit., p. 582.

[28]J. P. Guilford and W. S. Zimmerman, "The Guilford and Zimmerman Aptitude Survey," Journal of Applied Psychology, XXXII, 1948, p. 34.

Guilford and Zimmerman indicated that a battery of tests could be combined to yield fair predictions of success in vocational training. The exact nature of such a battery would vary, depending upon what tests were selected for it.

The utility of the battery will be determined by the amount of useful information obtained by the test. As stated in the Guide to the Use of the General Aptitude Test Battery, "In the final analysis, successful counseling depends upon the ability of the counselor to provide the applicant with sufficient information about himself and about the job market so that the client can decide upon a suitable vocational goal and plan which he accepts as desirable and achievable."[29]

The General Aptitude Test Battery

The GATB was first released by the United States Department of Labor in 1947 for use in employment counseling primarily with adults.[30] The first edition of the GATB (B-1001) contained 15 subtests and was designed to measure 10 aptitudes. As an outgrowth of research findings, based on the first edition, an improved version (B-1002)

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[29] U. S. Department of Labor, Guide to the Use of the General Aptitude Test Battery: Section III: Development, (Government Printing Office, Washington, D.C., 1962)p. 193.

[30] Margaret Culhane, "The General Aptitude Test Battery: Its Availability and Use," Vocational Guidance Quarterly, Vol. 13, No. 1, 1964, p. 64.

was released in 1952.[31] The revised edition contained twelve subtests and was designed to measure nine aptitudes. It is made up of eight paper-and-pencil subtests and four apparatus subtests. The entire test battery takes about two and one quarter hours to administer. The revised battery currently in use has been designed to measure the following aptitudes:[32]

G - Intelligence - General learning ability. The ability to catch on or understand instructions and underlying principles; the ability to reason and make judgements. Closely related to doing well in school.

V - Verbal aptitude - The ability to understand meaning of words and use them effectively. The ability to comprehend language, to understand relationships between words and to understand meanings of whole sentences and paragraphs.

N - Numerical Aptitude - Ability to perform arithmetic operations quickly and accurately.

S - Spatial Aptitude - Ability to think visually of geometric forms and to comprehend the two-dimensional representation of three dimensional objects. The ability to recognize the relationships resulting from the movement of objects in space.

P - Form Perception - Ability to perceive pertinent detail in objects or in pictorial graphic material. Ability to make visual comparisons and discriminations and see slight differences in shapes and shadings of figures and widths and lengths of lines.

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[31] U. S. Department of Labor, Manual for the General Aptitude Test Battery, Section III: Development, (U.S. Government Printing Office, Washington, D.C., 1970), p. 17.

[32] Ibid., p. 17.

Q - Clerical Perception - Ability to perceive pertinent detail in verbal or tabular material. Ability to observe differences in copy, to proofread words and numbers, and to avoid perceptual errors in arithmetic computation.

K - Motor Coordination - Ability to coordinate eyes, and hands or fingers rapidly and accurately in making precise movements with speed. Ability to make a movement response accurately and swiftly.

F - Finger Dexterity - Ability to move the fingers and manipulate small objects with the fingers, rapidly or accurately.

M - Manual Dexterity - Ability to move the hands easily and skillfully. Ability to work with the hands in placing and turning motions.

Raw scores from the test are converted to standard scores which have a mean of 100 and a standard deviation of 20. These are based on adult norms. One of the major advantages of the General Aptitude Test Battery over other aptitude test batteries is that the Occupational Aptitude Patterns derived from the GATB enable the counselor to relate the aptitudes of a client directly to a wide variety of occupations found in today's labor market.

The battery identifies aptitudes, which in conjunction with other counseling factors, assists counselors and clients to make effective vocational decisions. It is a real challenge for a counselor to relate an interpretation of the Occupational Aptitude Patterns (OAP's) to a student in a manner which is meaningful and stimulating to him.

Using the GATB with High School Students

Norms were first released for ninth and tenth grade in 1959. On the basis of data collected since that time and on maturation studies, updated normative information for ninth and tenth grade students has been released.[33]

As previously noted, occupations which require similar aptitudes have been grouped together to form Occupational Aptitude Patterns (OAP's). Each OAP consists of three of the nine aptitudes found to be significant for a certain family of occupations. The three significant aptitudes are reported in terms of cut-off scores. These scores represent the minimum scores found to be essential to successful performance in designated occupations. For each of the sixty-two OAP's there are reported not only adult norms but norms for grades nine and ten as well. Droege points out that OAP's for both ninth and tenth grades should be used with cutting score bands equal to plus or minus one standard error of measurement.[34] In addition, he suggests that interpretation should be restricted to those individuals whose scores fall inside the established confidence intervals when using OAP's with students from the lower high school grades.

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[33] Robert C. Droege, "GATB Norms for Lower High School Grades," Personnel and Guidance Journal, Vol. 39, (Sept., 1960), p. 34.

[34] Ibid., p. 35.

Culhane points out that until recently the United States Training and Employment Service completely controlled the administration of the GATB.[35] When the test was given to secondary school students, it was administered by a qualified employment service representative. With the development of ninth and tenth grade norms and increased interest on the part of the schools, U.S.T.E.S. established a policy that the senior state officers in each state may release the GATB form B-1002 to secondary schools.[36]

Results of Studies on the GATB in High Schools

Doeer and Ferguson explored the use of the GATBin selecting vocational-technical students.[37] They found that secondary school students enrolled in various trade and industrial curricula have measurable different aptitudes and interests. Students could be shown their aptitude and interest patterns which relate significantly to curriculum choices.[38]

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[35] Culhane, Op. Cit., p. 64.

[36] Ibid., p. 64.

[37] Joseph Doeer and John Ferguson, "The Selection of Vocational-Technical Students," The Vocational Guidance Quarterly, Vol. 17, No. 1, (September 1968), p. 367.

[38] Ibid., p. 369.

The GATB has also been studied as a predictor of success in vocational-technical education. Samuelson,[39] Intersall and Peters[40] said that multiple correlations .50 or better using three significant predictors can be considered high when predicting shop grades with the GATB. Droege, using a dichotomized criterion of good and poor grades obtained a multiple R of .38 using four GATB aptitudes.[41] Kapes hypothesized that the GATB is superior to other aptitude measures in predicting shop achievement because it contains manipulative as well as cognitive aptitudes.[42] These manipulative aptitudes made a significant contribution to the validity of the test.

Using the GATB with the Mentally Retarded

The Manual for the General Aptitude Test Battery states that one of the contributions of the GATB is that it provides for measurement of a variety of aptitudes

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[39] C. E. Samuelson, "The General Aptitude Test Battery in Predicting Success of Vocational School Students," Journal of Educational Research, Vol. 50, 1956, pp. 175-182.

[40] R. W. Intersall and H. J. Peters, "Predictive Indices of the GATB," Personnel and Guidance Journal, Vol. 44, 1966, pp. 431-37.

[41] Robert C. Droege, "Effects of Aptitude-Score Adjustments By Age Curves on Prediction of Job Performance," Journal of Applied Psychology, Vol. 51, No. 2, 1967, p. 186.

[42] Jerome T. Kapes, "Exploring the Use of the GATB with Vocational Technical Bound Ninth Grade Boys," ERIC ED (January 1969), pp. 526-536.

important for occupational success, not just for intelligence.[43] If such differential aptitude measurement is important in the vocational counseling of individuals with normal intelligence, it is even more important in counseling intellectually retarded individuals.

Studies by Murray[44] and Huddy[45] have indicated that the GATB is useful in counseling the mentally retarded. The GATB Manual states that it provides for measurement of a variety of aptitudes important for occupational success. Since educational deficiency is the most pervasive factor in educable retardates, a major consideration in using the test with EMR's is the extent to which basic educational skills are required. Of the twelve tests of the GATB, eight require no reading or arithmetic ability.

Murray showed that although the retarded were scoring low on the aptitudes which required reading or arithmetic skills, many were scoring much higher on aptitudes which didn't require specific educational skills.[46] Occupational

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[43] U. S. Dept. of Labor, Op. Cit., (Manual), p. 311.

[44] Evelyn Murray, "The Vocational Potential of the Retarded," Vocational Guidance Quarterly, Vol. 7, 1958, pp. 3-8.

[45] J. A. Huddy, "An Analysis of Occupational Aptitudes of Educable Mentally Retarded and Slow Learning Pupils in Relation to the General Aptitude Test Battery," Unpublished Doctoral Dissertation, (Syracuse University, 1968), p. 71.

[46] Murray, Op. Cit., p. 8.

aptitude patterns were identified in vocational areas which did not require high general intelligence and verbal aptitude scores. Huddy's results were similar to Murray's in finding that some students with general intelligence and verbal aptitude scores under 75 achieved better than average scores in other aptitudes.[47]

Even so, the GATB is not able to provide counselors with accurate information on the general intelligence aptitude of students with educational deficiencies. The Manual for the General Aptitude Test Battery states that "the inability of an individual to follow test instructions or to read and understand test items renders the administration of certain tests unfair as valid measures of the aptitudes and abilities which the tests are intended to measure."[48] For this reason, the U. S. Department of Labor has designed the Nonreading Aptitude Test Battery (NATB) to measure the same aptitudes as the General Aptitude Test Battery using tests which do not require reading.[49]

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[47]Huddy, Op. Cit., p. 63.

[48]U. S. Department of Labor, Op. Cit., p. 353.

[49]U. S. Department of Labor, Manual for the Nonreading Aptitude Test Battery: Form A, (U.S. Government Printing Office, Washington, D.C., 1970), p. iii.

The Nonreading Aptitude Test Battery

Recently the United States Training and Employment Service released the Nonreading Aptitude Test Battery (NATB) which is an adaption of the General Aptitude Test Battery (GATB).[50] The GATB is widely used in schools and in the Employment Service for the measurement of occupational aptitudes.

In its present form, the GATB is not appropriate for use with individuals who are severely culturally and educationally disadvantaged.[51] Many people who need vocational counseling and remedial services to help them become employable are unable to take the tests because they are illiterate and have difficulty understanding the directions and marking answers on a separate answer sheet. The GATB requires a reading ability at about the seventh grade level.[52]

These problems led the U. S. Employment Service to work toward development of nonreading aptitude tests suitable for use with the disadvantaged. The GATB aptitude

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[50] R. L. Droege, W. Showler, S. Bemis, and J. Hawk, "Development of a Nonreading Edition of the General Aptitude Test Battery," Measurement and Evaluation in Guidance, Vol. 3, No. 1, (Spring, 1970), p. 45.

[51] R. C. Droege and John Hawk, "A Factoral Investigation of Nonreading Aptitude Tests," Proceedings, 78th Annual Convention of the American Personnel and Guidance Association, (1970), p. 45.

[52] Wayne Carbuhn, Ivan Wells, "Use of Nonreading Aptitude Tests (NATB) for Selecting Mental Retardates for Competitive Employment," Measurement and Evaluation in Guidance, Vol. 5, No. 4, (January 1973), p. 461.

structure was used as the model in this research because it measures vocationally significant aptitudes and has extensive occupationally validated norms for score interpretation.[53] The studies leading to the development of the nonreading edition of the GATB are described in a technical report published by the U. S. Training and Employment Service.[54]

The purpose of the NATB is to identify disadvantaged clients' major vocational aptitudes in order to determine their standing on 62 occupational aptitude patterns (OAP's) of jobs requiring similar groupings of aptitudes. The battery consists of the following 14 tests: picture-word matching; oral vocabulary; coin matching; matrices; tool matching; three-dimensional space; form matching; coin series, name comparison; mark making (GATB, part 8); place (GATB, part 9); turn (GATB, part 10); assembly (GATB, part 11); and disassemble (GATB, part 12). As with the GATB, 14 tests of the NATB were developed to measure intelligence verbal aptitude, numerical aptitude, spatial aptitude, form perception, clerical perception, motor coordination, finger dexterity, and manual dexterity.

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[53] Carbuhn and Wells, Op. Cit., pl 463.

[54] U. S. Department of Labor, Manual for the General Aptitude Test Battery, Section III: Development, (U.S. Government Printing Office, Washington, D.C., 1967).

In describing the development of the nonreading edition of the GATB, Droege and others have concluded that on the basis of several item analyses and validation studies they recommend the NATB for use with severely culturally and educationally disadvantaged individuals.[55] The manual for the Nonreading Aptitude Test Battery states that:

> the results of the developmental research indicate that cautious operational use of the battery is justified when the scores are used in conjunction with GATB occupational norms. These are to be regarded as interim norms, pending development of norms based on direct occupational validation of the nonreading tests for disadvantaged groups.[56]

The community placement unit at Fairview Hospital and Training Center for the mentally retarded in Salem, Oregon reports that they have used the NATB for selecting and estimating the performance of MDTA vocational trainees.[57] Those trainees were below normal intelligence and were living at the institution. The research indicated they were able to identify NATB factors that significantly differentiated the vocational trainees rated as good and

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[55] U. S. Employment Service, Dept. of Labor, Development of a Nonreading Edition of the General Aptitude Test Battery, (U.S.E.S. Test Research Report No. 23, Washington, D.C., November 1968).

[56] U. S. Employment Service, Manual for the Nonreading Aptitude Test Battery, Section I, (U.S. Gov't. Printing Office, Washington, D.C., 1970).

[57] Carbuhn and Wells, Op. Cit., p. 460.

excellent workers from those rated as fair and poor competitive workers by on-the-job training supervisors. After completing the on-the-job training period, the succesful trainee was usually hired for regular competitive employment, whereas the fair or poor rated trainee was not.

The Fairview Heights staff also determined the level of intelligence necessary for appropriate administration of the test. Carbuhn and Wells stated that:

> The NATB is not appropriate for use with all levels of mental retardates, since comprehension of the instructions requires a minimum level of intellectual ability (I.Q. 40 and above).[58]

Although Carbuhn and Wells' research involved institutionalized retardates, the authors felt that their research could be generalized to students in special education classes or to slow learners in regular public school classes.[59] They concluded that school and rehabilitation counselors and other guidance personnel should find the NATB a valuable additional source of measurement data for differential assessment of vocational aptitude.

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[58] Carbuhn and Wells, Op. Cit., p. 460.

[59] Ibid., p. 466.

Summary

This review of the literature shows consensus in the following areas:

1) Most mentally retarded (approximately 85%) can acquire vocational skills and lead productive lives.

2) The employability of the retarded can be enhanced by providing training in areas where aptitude and potential exist.

3) Certain characteristics commonly attributed to the retarded are also characteristic of the culturally disadvantaged.

4) The higher the skill level of the trade, the greater the relationship between intelligence and success in the trade. Intelligence is a less significant factor in semi-skilled and unskilled jobs.

5) The GATB is an effective instrument for measuring occupational aptitudes and provides useful information for counseling purposes. Since the minor effects of age can be handled by standardized adjusted norms, it can be used equally well with high school students and young adults.

However, the literature does not offer conclusive evidence that the nonreading edition of the GATB which has been developed for use with disadvantaged individuals is applicable to educable mentally retarded secondary students. The intent of this study is to investigate the extension of that applicability to educable mentally retarded students as defined in this study.

CHAPTER III

METHODOLOGY

Introduction

This chapter focuses on the methodology employed in the study. It includes a brief review of the problem, a depiction of the characteristics of Vermont's secondary level EMR population, a portrayal of the program in which this population is enrolled, and a delineation of the sample involved in the study.

In addition, the chapter includes a listing of the procedures followed and a description of the data instruments and computer analyses related to the study.

The Problem

This study is an attempt to determine if the NATB is a reliable instrument for identifying occupational aptitude patterns of educable mentally retarded and borderline intelligence vocational educational students. In addition to this, the study includes an investigation of the relationship between reading comprehension scores as measured by the Peabody Individual Achievement Test and

NATB, GATB scores. Similarly, a comparison is made between individual I.Q. scores and NATB, GATB scores. That is to say, this research has two principle objectives. One objective is to determine if the Nonreading Aptitude Test Battery renders findings that correlate with other tests commonly used to assess aptitude or potential for achievement of students with learning handicaps. The other objective is to determine if the NATB identifies more OAP's for students in this sample than the more widely known General Aptitude Test Battery.

The Population

In Vermont, all educable mentally retarded students of high school age may enroll in occupational training programs within Area Vocational Centers. These programs, called Diversified Occupations (D.O.) programs, were initiated by the Vermont Department of Education during the late sixties in an attempt to compel local education agencies to respond to the vocational training needs of retarded adolescents then consigned to segregated special schools where little or no vocational training was available.

To be designated as educable mentally retarded, a student must fill two principle criteria. First, he must manifest the conditions inherent in the formal definition

of mental retardation. These include 1) significant subaverage intellectual functioning and 2) deficits in adaptive behavior. In actuality, a series of tests and observations are made by medical, psychological, and educational professionals before a student is labelled as Educable Mentally Retarded.

At least two individual intelligence tests are administered. Generally, these include the WISC, Binet or Otis tests. It is important to note, however, that retardation cannot be determined solely on the basis of performance on I.Q. tests. A student's educational, developmental and social history must likewise indicate achievement and rate of achievement that is significantly below expected norms for his chronological age. Thus, retardation always reflects a cluster of criteria. While retarded mental development may be suspected of an individual during his preschool years, it is seldom confirmed until after the child has attended kindergarten or the first grade. And to protect children from falacious diagnosis, the Vermont Department of Education requires all EMR's to be reevaluated every five years. Thus, the students who enter the D.O. programs have been evaluated at least twice prior to their placement in the program. Students in D.O. programs range in age from 15 to 21, the mean age being 17. One should note that the definition of retardation is not rigid and as recently as 1973 was changed to incorporate

only those students whose I.Q. level is two standard deviations below the mean of 100, approximately 70 and lower. Formerly, the limit was set at one standard deviation. Because of this recent change in definition, which has yet to be adopted as a matter of policy by the Vermont Department of Education, students are currently enrolled in D.O. programs with I.Q.'s ranging between 45 and 85.

The Diversified Occupations Programs

Diversified Occupations Programs in area vocational centers throughout Vermont prepare high school aged educable mentally retarded students to become self-supporting members of their communities.

The first of the program's three phases is an evaluation or exploratory phase. Special laboratory facilities provide hands-on experiences that reveal student interests and skills. In Phase Two, students are given intensive preparation in areas where they have the greatest chance for success. After this experience, the majority of D.O. students are integrated into the regular vocational programs. Here they complete their training and are then placed in work-experience programs in Phase Three.

Those students who have little chance of succeeding in vocational programs receive the third phase of their training in the diversified occupations facilities.

Diversified occupations staff members attempt to match the students with appropriate jobs in the community, provide intensive training in the laboratory (based on a task analysis of the job); and place the students in relevant work-experience situations.

The Sample

Originally, it was intended that this study include all of the 280 students enrolled in Vermont's Diversified Occupations programs. This was not possible for two reasons. Mr. Robert J. Brown, Associate Manpower Administrator for the United States Training and Employment Service, advised the writer to limit any studies to students who are at least 16.[1] This is because the score adjustments for maturation would render invalid any scores obtained from students under 16. Eliminating those under 16 resulted in a sample of 180. And, due to absences on test days, or missing data, this number was reduced by 22% to 140.

Table 1 depicts how this sample was distributed on the basis of sex and age. Seventy-three males were included in the study. Their mean age was 17.5 with a standard

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[1]Based on personal correspondence between Dr. Robert J. Brown, Associate Manpower Administrator for the United States Employment Service, and the writer.

deviation of 1.2. In addition, sixty-seven females were included whose mean age was 17.3 and whose standard deviation was 2.2.

Table 1

A Comparison of the Mean Age and Standard Deviation of Student Sample

Sex	N	$\bar{X}$ Age	S.D.	Range
Male	73	17.5	1.2	16.1 - 20.3
Female	67	17.3	2.2	16.0 - 20.7
Total	140			

Table 2 depicts the mean full scale I.Q. of the sample which was 69.18 with a standard deviation of 9.9. To make the Stanford-Binet and Weschler full scale I.Q. scores comparable an adjustment of two points was added to the scores of the forty-six students whose scores were derived from the Stanford-Binet Intelligence Test.[2] Also shown in Table 2 is the performance I.Q. of the sample with

[2]Herbert J. Grossman, Manual on Terminology and Classification in Mental Retardation, American Association on Mental Deficiency, 1973 Revision, p. 18.

a mean of 73.78 and a standard deviation of 12.50. The verbal I.Q. shown has a mean of 68.73 and a standard deviation of 10.19. Only ninety-four students had verbal and performance I.Q. sub scores. The forty-six students who did not have these scores were those tested with the Stanford-Binet Intelligence Scale.

Table 2

Full Scale, Verbal and Performance
I.Q. Scores and Standard Deviations of Sample

I.Q. Measures	N	$\bar{X}$ Scores	S.D.
Full Scale I.Q.	140	69.18	9.9
Performance I.Q.	94	73.78	12.50
Verbal I.Q.	94	68.73	10.19

Table 3 depicts various I.Q. ranges. These correspond roughly to standard deviations from the mean for the Weschler and Stanford-Binet I.Q. tests. Note that six students have full scale I.Q.'s within the range of 41-50. As one can observe, sixteen students were in the 51-60 range, and fifty-eight students fell within the 61-70 range. Most of the sample fell into one of the two ranges between 51 and 70. These students would be considered the educable mentally retarded segment of the sample. Forty-seven

students had I.Q. scores in the borderline intelligence range. There were thirteen students with I.Q.'s above 80.

Table 3

A Comparison of the Distribution Ranges of Full Scale I.Q.'s of the Students in the Sample

Full Scale I.Q. Range	N	Percent
41-50	6	4.23
51-60	16	11.47
61-70	58	41.42
71-80	47	33.52
81-90	13	9.36
Total	140	100.00

The mean Peabody reading grade level of the ninety-nine students for whom Peabody scores were available was 3.61 with a standard deviation of 1.59. There were forty-one students in the total sample of one hundred forty for whom current reading grade scores were not available.

Table 4 depicts the number and percent of students scoring at various reading grade levels. Only one student read below the first grade level. Four students read

between grade 1.1 and 2. In contrast, thirty-seven students within the sample of ninety-nine read between grade 2.1 and 3. Another thirty students read between grade 3.1 and 4. Between the fourth and fifth grade reading levels there were fourteen students; between grades five and six there were five students. Of the ninety-nine students only eight could read above an eighth grade level.

Table 4

A Comparison of the Distribution of Reading Grade Level Ranges Measured by the Peabody Individual Achievement Test

Reading Grade Level Range	N	Percent
below 1	1	1.01
1.1-2	4	4.04
2.1-3	37	37.37
3.1-4	30	30.31
4.1-5	14	14.14
5.1-6	5	5.05
6.1 & over	8	8.08
Total	99	100.00

Procedure

Numerous activities were transacted in order to complete this study. These activities may be divided into four phases of implementation: (1) planning, (2) investigation, (3) generalization, and (4) summary. Major activities completed during each plase are listed chronologically and briefly annotated below.

Planning phase: The first major activity of the study was an extensive review of the literature in the area of occupational aptitude testing for adolescent educable mentally retarded pupils. Specifically, the literature was studied to determine what research had been completed in the following areas: (a) the cultural background and employability of mental retardates, (b) the identification of occupational aptitudes of the mentally retarded, (c) the use of the General Aptitude Test Battery and its predictability, and (d) the use of the General Aptitude Test Battery and the Nonreading Aptitude Test Battery with mentally retarded students.

Next, personnel from the Vermont State Department of Education and the Vermont Department of Employment Security were contacted and their cooperation in the study was obtained. After this, a letter was sent to the directors of Vermont's Area Vocational Centers requesting their cooperation along with their Vocational Guidance and

days.

As soon as the GATB had been administered, training sessions for the NATB were held. One Diversified Occupations instructor from each center in company with a vocational guidance counselor attended these sessions. Because these individuals had never used the NATB, it was anticipated that numerous questions would be raised once the testing was underway. For this reason, staff from the University and the Department of Education worked closely with each center as they administered the tests.

Once administered, completed GATB and NATB tests were collected and scored. Data needed for each student was carefully screened for completeness and accuracy. Certain students were eliminated from the study at this point due to lack of information about the student or the existence of other handicapping conditions which would distort their performance. For example, all cerebral palsied students were eliminated because their scores on the manipulative segment of the exam would not be an accurate indication of their aptitude for manipulative tasks.

Next, test data was recorded on student profile cards with such other variables as I.Q. and Peabody Reading Comprehension scores. (See Appendix) The data was key punched and verified at the State Data Processing Center in Montpelier, Vermont. Finally, an analysis of all data was completed at the University of Connecticut's Data

Diversified Occupations staff. All of the Area Vocational Centers and Vocational Guidance and Diversified Occupations staffs pledged their support to the project.

Also during the planning phase, a letter was sent to the U. S. Department of Labor's Manpower Administration requesting permission to use United States Training and Employment Service test materials for research purposes. Permission was granted and a release agreement was signed. (See Appendix)

Investigation phase: One of the most time consuming and critical activities during the investigation phase was the administration of the GATB to all students included in the study. Testing materials were distributed to a qualified test administrator--usually a vocational guidance counselor--from each area vocational center. The distribution and explanation of the study were made at a regular monthly meeting of area vocational center guidance personnel. A target date for completion of the testing was mutually arranged. There was incentive for the guidance personnel to participate in the testing because their activity was part of the requirements for a graduate course they were participating in at the University of Vermont. In area centers with more than fifteen students to be tested, personnel from the University of Vermont and the Vermont Department of Education provided assistance. For the most part, the GATB testing was completed within thirty

Analysis Center. It took approximately 90 days to complete the NATB training and testing.

Generalization phase: Based on the data derived from previous analysis activities, each hypothesis for the study was tested. Following this, a final report was written which included (1) a summary of the findings, (2) recommendations for further study, and (3) implications for counseling secondary level EMR students using NATB/GATB aptitude measures. This phase is further detailed in Chapter 4.

Summary phase: Results of the research were disseminated to (a) all D.O. teachers in the state of Vermont, (b) all area vocational center guidance personnel, (c) directors of area vocational centers, (d) resource libraries of area vocational centers, (e) area directors of vocational rehabilitation, and (f) any other individuals requesting a copy. A condensed version of the study was prepared for submission to the professional journals that focus on the training of educable mentally retarded youth.

Data Analysis

The data analysis for this study was completed at the University of Connecticut Computer Center. The Tele-Storage and Retrival System, (TSAR), a packaged computer program, was utilized for the data analysis.

TSAR procedure MEAN was used to obtain the various means, standard deviation, variance, and other descriptive statistics for each of the variables observed in the study. TSAR procedure RELATED T was used to determine if the mean number of OAP's identified by the NATB was significantly higher than the mean number of OAP's identified by the GATB. TSAR Fortran Sub-Program TFCORR was utilized to develop a matrix of Pearson Product Moment Correlation Coefficients. Finally, the TSAR Fortran sub-program TFREQ was used to obtain frequency counts of selected variables by intervals which were used in describing the sample.

Summary

It was the purpose of this chapter to present the following: (1) a description of the population studied, (2) a description of the Diversified Occupations programs, (3) a delineation of the sample, (4) a summary of procedure followed in the study, and (5) a description of the data analysis systems utilized.

In the chapter to follow a detailed presentation will be rendered concerning the outcomes of the statistical treatments and the hypotheses previously stated.

CHAPTER IV

RESULTS AND DISCUSSION

Introduction

As previously noted, the primary objective of this research is to determine if the NATB will identify significantly more vocational aptitudes for secondary level educable mentally retarded and borderline intelligence students than its more verbally oriented counterpart, the GATB. Or, one could say that this research effort attempts to answer the question: Is the NATB a better vocational counseling instrument than the GATB for use with mentally retarded and borderline intelligence groups?

It is generally agreed that the recognition of aptitude combined with corresponding occupational training plays a vital role in enabling the retarded to emerge in more productive work roles and to participate more fully in their communities as contributing citizens.

This chapter will present the data as it pertains to the hypotheses defined in Chapter I.

Findings of Hypothesis 1

Hypothesis 1 - The number of Occupational Aptitude Patterns as determined by the General Aptitude Test Battery and the Nonreading Aptitude Test Battery will be positively related.

Recall from the review of the literature in Chapter 1 that an Occupational Aptitude Pattern consists of the most significant aptitudes and the critical scores on these aptitudes established as minimum scores for a group of occupations having similar aptitude requirements. The occupational titles and codes for the occupations shown in the occupational aptitude pattern structures are taken from the Dictionary of Occupational Titles. There are sixty-two Occupational Aptitude Patterns which encompass thousands of jobs listed in the dictionary.

In testing Hypothesis 1, a Pearson Product-Moment Correlation coefficient was generated to determine the degree of relationship inherent between the number of OAP's identified by the two aptitude test batteries. The analysis resulted in a correlation coefficient of .85 which was determined to be significant beyond the .005 level of probability. That is to say, the number of OAP's identified by the GATB and NATB for one hundred forty students were highly related. Most students who obtained a large number of OAP's using the GATB would obtain as large or a larger

number of OAP's using the NATB. In contrast, any student who obtained no OAP's when tested by the GATB either obtained no OAP's on the NATB or obtained very few.

Thus, Hypothesis 1 determined that a substantially positive relationship existed between the number of OAP's obtained on both tests. A further analysis of this relationship is stated in Hypothesis 2.

Findings of Hypothesis 2

Hypothesis 2 - The Nonreading Aptitude Test Battery will identify more Occupational Aptitude Patterns than the General Aptitude Test Battery.

In analyzing Hypothesis 2, it was found that the mean number of OAP's identified by the NATB for each student was significantly higher than the mean number of OAP's identified by the GATB. As one can see from Table 5, the mean number of OAP's identified by the GATB for each student was 3.70 with a standard deviation of 6.49. In contrast, the mean number of OAP's identified by the NATB for each student was 7.10 with a standard deviation of 9:45. To determine the difference between the GATB mean of 3.70 and the NATB mean of 7.10 a t test was used.

Table 5

The Difference Between the Mean Number of OAP's Determined by the GATB and the NATB

Test	N	S.D.	$\bar{X}$ Number of OAP's	t
GATB	140	6.49	3.70	7.64[a]
NATB	140	9.45	7.10	

[a] Significant beyond the .0005 level

A related t test was considered appropriate to determine the mean difference between the number of OAP's obtained by the GATB and NATB. The related t test showed that the mean number of OAP's identified by the NATB was significantly higher than the mean number of OAP's identified by the GATB. Because the total number of paired observations for the study was 140, the degrees of freedom (number of paired observations minus one) was 139. As one may observe in Table 5, a t score of 7.64 was obtained and determined to be significant beyond the .0005 level.

To further illustrate what has been previously stated, the reader may consult Table 6. Here it is shown that out of sixty-two possible OAP's which could be obtained on the two tests, both the male and female populations obtained significantly more OAP's from the NATB than from the GATB.

Table 6

The Number of OAP's Attained By Educable Mentally Retarded and Borderline Intelligence Students Who Attained Occupational Aptitude Patterns Using Tenth Grade National Norms

Occupational Aptitude Pattern Numbers	Males n=73		Females n=67	
	GATB	NATB	GATB	NATB
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
10	0	1	0	1
11	0	2	0	1
12	0	1	0	1
13	0	1	0	0
14	1	1	0	1
15	0	2	0	2
16	0	3	0	1
17	0	1	0	0
18	1	3	0	1
19	4	11	1	3
20	1	3	0	2
21	2	10	0	4
22	9	19	5	5
23	6	17	3	13
24	7	27	7	15

Table 6 (Continued)

Occupational Aptitude Pattern Numbers	Males n=73 GATB	Males n=73 NATB	Females n=67 GATB	Females n=67 NATB
25	4	9	4	11
26	2	4	2	4
27	2	3	2	4
28	8	18	9	10
29	0	0	1	2
30	0	1	1	2
31	0	1	0	3
32	0	2	0	3
33	0	2	0	6
34	1	9	0	5
35	2	8	0	6
36	0	9	1	7
37	1	11	0	6
38	4	14	1	9
39	4	15	3	14
40	5	20	2	12
41	4	15	4	17
42	6	21	7	12
43	10	17	6	15
44	5	14	7	10
45	11	17	14	19
46	9	16	7	9
47	9	15	7	12
48	26	37	14	25
49	11	19	6	11
50	6	8	4	4
51	13	17	7	10
52	20	30	15	21
53	10	11	6	8

Table 6 (Continued)

Occupational Aptitude Pattern Numbers	Males n=67		Females n=67	
	GATB	NATB	GATB	NATB
54	6	6	8	12
55	18	22	16	19
56	18	22	11	14
57	4	6	5	4
58	5	9	7	6
59	10	12	10	11
60	9	12	8	8
61	5	6	5	5
62	13	16	8	8

Findings of Hypothesis 3

Hypothesis 3 - Measured I.Q. will be positively related to the General Aptitude Test Battery scores and the Nonreading Aptitude Battery scores.

In testing Hypothesis 3, a series of Pearson Product-Moment Correlation coefficients were generated to determine the significance of the relationship between certain scores. This time a degree of relationship was sought between each subject's full scale I.Q. score and his GATB and NATB aptitude scores. In order to compensate for the forty-three

subjects whose I.Q. scores were derived from the Stanford-Binet intelligence scale, two points were added to their scores. This made all I.Q. scores comparable.

It is evident from Table 7 that all of the GATB and NATB aptitude scores except NATB-Q and GATB-Q were significantly related to the full scale I.Q. scores. Aptitude Q-Clerical Perception is tested similarly by both the NATB and GATB. This test measures the ability to observe differences in copy, to proofread words and numbers and to avoid perceptual errors in arithmetic computation. The Clerical Perception aptitude measures speed of perception[1] which is required in many industrial jobs even when the job does not have verbal or numerical content. The lack of a significant relationship between Clerical Perception and Full Scale I.Q. is a notable exception. Many industrial occupations require speed of perception but do not require a high level of intelligence or reading ability.

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[1]U. S. Department of Labor, Manual for the General Aptitude Test Battery, Section III: Development, U. S. Gov't Printing Office, Washington, D.C., 1970, p. 17.

Table 7

The Relationship of Full Scale I.Q. Scores to NATB and GATB Aptitude Scores for 140 Students

GATB-NATB Subtests	r	$\bar{X}$	S.D.	Level of Signigicance
GATB				
G-Intelligence	.360	64.41	13.92	.005
V-Verbal Aptitude	.158	73.69	15.68	.025
N-Numerical Aptitude	.377	60.32	13.04	.005
S-Spatial Aptitude	.362	81.16	14.26	.005
P-Form Perception	.402	78.08	19.58	.005
Q-Clerical Perception	.114	89.52	13.57	N.S.
K-Motor Coordination	.225	68.39	25.50	.005
F-Finger Dexterity	.287	65.62	23.92	.005
M-Manual Dexterity	.359	64.87	30.97	.005
NATB				
G-Intelligence	.508	71.32	11.47	.005
V-Verbal Aptitude	.235	69.86	12.37	.01
N-Numerical Aptitude	.485	70.84	14.83	.005
S-Spatial Aptitude	.406	93.00	16.58	.005
P-Form Perception	.376	103.41	20.98	.005
Q-Clerical Perception	.122	99.62	14.34	N.S.

NOTE: Motor Coordination (K), Finger Dexterity (F), and Manual Dexterity (M) are the same for each test.

Findings of Hypothesis 4

Hypothesis 4 - The verbal sub scores of the individualized I.Q. test will have a significantly higher relationship to the cognitive aptitude scores (G.V.S.N.) of the General Aptitude Test Battery than the cognitive aptitude scores of the Nonreading Aptitude Test Battery for the following scales: G.V.S.N.

In testing Hypothesis 4 a series of Pearson Product-Moment Correlation coefficients were computed to determine the relationship between the verbal sub score of the I.Q. tests and (1) each of the four General Aptitude Test Battery cognitive aptitude scores (G,V,S,N) and (2) each of the Nonreading Aptitude Test Battery cognitive aptitude scores (G,V,S,N).

Table 8 shows that the resulting eight correlations were arranged by like cognitive aptitudes, in pairs. The table lists the resulting pairs and Pearson Product-Moment Correlation coefficients for each aptitude showing its relationship to the verbal I.Q. sub score.

Table 8

Correlations Between V I.Q. and Cognitive Aptitude Scores for the GATB and NATB and t Values Obtained to Determine the Significance of the Difference Between the Correlation Coefficients

Cognitive Aptitude Score	Correlations GATB	NATB	t	Level of Significance
G	.345	.438	.964	N.S.
V	.175	.276	.796	N.S.
S	.210	.195	.181	N.S.
N	.377	.320	.595	N.S.

A t-test for the significance of the difference between two nonindependent correlation coefficients was utilized to determine whether the two Pearson Product-Moment Correlation coefficients for each of the four pairs of variables differed significantly.[2] The method of computation was:

$$t = (r_1 - r_2)\sqrt{\frac{(n-3)(1+r_{12})}{2(1-r_1^2-r_2^2-r_{12}^2+2r_1r_2r_{12})}}$$

[2]Allen L. Edwards, Experimental Design in Psychological Research, 4th Edition, Holt, Rinehart, & Winston, New York, N.Y., 1971, p. 85.

where

t is evaluated for significance by reference to a Distribution of t Table with n-3 degrees of freedom.

r_1=correlation coefficient of variable x_1 with variable y.

r_2=correlation coefficient of variable x_2 with variable y.

r_{12}=correlation coefficient of variable x_1 with variable x_2.

n=number of subjects in the group.

The resultant t-test scores obtained in the computation are shown in Table 8. None of the t values were significant at the .01 level.

Findings of Hypothesis 5

Hypothesis 5 - The performance sub scores on the individualized I.Q. test will be positively related to the Nonreading Aptitude Test Battery scores and the dexterity and perceptional scores of the General Aptitude Test Battery.

Again, a series of Pearson Product-Moment Correlation coefficients were compiled to test Hypothesis 5. This time the analysis sought to determine whether or not a positive relationship exists between Performance I.Q.'s and those segments of the GATB and NATB tests that do not

require reading, i.e. all of the NATB aptitude measures and the dexterity and perceptual segments of the GATB, or tests P, Q, X, F and M. The number of students for whom both performance I.Q. scores as well as GATB and NATB scores were available was ninety-three. This occurs because only the WISC Intelligence scale renders a performance score.

Table 9 depicts the relationship between Performance I.Q. and each of the NATB aptitude measures and the GATB aptitude measures for perception and dexterity. Here one can observe that a positive relationship existed for all aptitude measures with the exception of Q-Clerical Perception and K-Motor Coordination on both tests.

Table 9

The Relationship Between Performance I.Q. Score, NATB Scores, and Selected GATB Scores (P,Q,K,F,M) for 93 Students

GATB-NATB Subtests	N	r	$\bar{X}$	S.D.	Level of Significance
NATB					
G-Intelligence	93	.555	71.32	11.47	.005
V-Verbal Aptitude	93	.219	70.03	12.40	.025
N-Numerical Aptitude	93	.488	70.84	14.83	.005
S- Spatial Aptitude	93	.536	93.00	16.58	.005
P-Form Perception	93	.532	103.41	20.98	.005
Q-Clerical Perception	93	.121	99.62	14.34	N.S.
GATB					
P-Form Perception	93	.472	78.08	19.58	.005
Q-Clerical Perception	93	.118	89.52	13.57	N.S.
K-Motor Coordination	94	.163	68.39	25.50	N.S.
F-Finger Dexterity	94	.403	65.62	23.92	.005
M-Manual Dexterity	94	.417	64.87	30.97	.005

NOTE: Motor Coordination (K), Finger Dexterity (F), and Manual Dexterity (M) are the same for each test.

It was anticipated that those students with the higher performance I.Q.'s would likewise score high on the NATB aptitude measures as well as the GATB perception and dexterity measures. For the most part, this relationship occurred at the .005 level with the exception of the clerical perception and motor coordination measures as

previously noted. This exception will be discussed in greater detail in Chapter 5.

Findings of Hypothesis 6

Hypothesis 6 - Measured reading comprehension will be positively related to both the General Aptitude Test Battery scores and the Nonreading Aptitude Test Battery scores.

Hypothesis 6 stated that measured Reading Comprehension grade level would be positively related to all GATB and NATB aptitude measures. Therefore, a series of correlation coefficients were generated to determine the nature of this relationship. A review of Table 10 shows that a significant relationship did exist between measured reading comprehension scores and aptitude scores for G (intelligence), V (verbal ability), N (numerical), and K (motor coordination). Although it was anticipated that the reading scores would positively relate to aptitudes G, V, and N of the GATB, it was not anticipated that this relationship would be found for the corresponding G, V, and N scores of the NATB.

While the NATB was designed to assist people with low reading ability, it became clear after the data analysis that skill in reading is related even to one's NATB G, V, and N scores. In comparing the correlations for Aptitudes G

(GATB-G r=.373 NATB-G r=.368) and V (GATB-V r=.351 NATB-V r=.357) the results are very similar. As one can observe, these differences of coefficients are virtually negligible. For aptitude N, however, this similarity does not exist. Aptitude N of the GATB has a correlation coefficient of .369 while the NATB aptitude N has a lower correlation coefficient of r=.211.

Table 10

The Relationship of Reading Comprehension Grade Level to GATB and NATB Scores for 99 Students[a]

GATB-NATB Subtests	r	$\bar{X}$	S.D.	Level of Significance
NATB				
G-Intelligence	.368	70.25	11.92	.005
V-Verbal Aptitude	.357	68.32	12.83	.005
N-Numerical Aptitude	.211	69.12	14.87	.025
S-Spatial Aptitude	.066	92.27	16.53	N.S.
P-Form Perception	.158	101.45	19.87	N.S.
Q-Clerical Perception	.089	97.43	12.63	N.S.
GATB				
G-Intelligence	.373	63.15	15.58	.005
V-Verbal Aptitude	.351	72.01	17.70	.005
N-Numerical Aptitude	.369	59.46	13.90	.005
S-Spatial Aptitude	.099	79.91	14.56	N.S.
P-Form Perception	.107	75.45	19.57	N.S.
Q-Clerical Perception	.085	87.77	14.19	N.S.
K-Motor Coordination	.212	66.90	25.88	.025
F-Finger Dexterity	.162	62.32	23.79	N.S.
M-Manual Dexterity	.025	65.60	31.78	N.S.

[a]Reading Comprehension scores were available for only 99 students.

In reviewing Table 10 one should note that Motor Coordination (K), Finger Dexterity (F), and Manual Dexterity (M) are the same for each test.

Additional Findings

It should be noted that the findings for Hypotheses 1 and 2 are consistent with those of earlier studies. Huddy, for example, found that pupils in the higher I.Q. ranges showed more OAP's than those with I.Q.'s in the lower ranges.[3] As one can observe in Table 11, this pattern held true for this study as well; pupils in the higher I.Q. ranges showed more OAP's for both the GATB and the NATB.

Table 11

A Tabulation of the Mean Number of GATB/NATB OAP's Obtained by 140 Students Depicted by I.Q. Ranges

Full Scale I.Q.	N	$\bar{X}$ NOAP	$\bar{X}$ GOAP
41-50	6	1.47	.26
51-60	19	3.5	1.0
61-70	53	6.2	3.7
71-80	48	9.6	4.4
81-90	14	11.1	6.9

[3] J. A. Huddy, "An Analysis of Occupational Aptitudes of Educable Mentally Retarded and Slow Learning Pupils in Relation to the General Aptitude Test Battery," Unpublished Doctoral Dissertation, (Syracuse University, 1968), p. 60.

Table 12 shows the difference between the aptitude scores attained by students on both tests. The participants in this study scored significantly higher (beyond the .001 level) on all of the aptitudes measured by the NATB except the Verbal. NATB verbal scores averaged 3.5 points lower than GATB verbal scores. Even so, the gains in other aptitude areas using the NATB were so significant as to yield considerably more OAP's than the GATB.

Table 12

The Difference Between Aptitude Scores Attained by 140 Educable Mentally Retarded and Borderline Intelligence Students on the NATB and GATB

Aptitudes	$\bar{X}$ NATB Scores	S.D. NATB	$\bar{X}$ GATB Scores	S.D. GATB	t Score	Level of Significance
Intelligence (G)	71.22	11.37	64.41	13.92	5.86	.001
Verbal Aptitude (V)	69.86	12.38	73.69	15.68	-2.51	.02
Numerical Aptitude (N)	70.84	14.68	60.33	13.04	8.43	.001
Spatial Aptitude (S)	92.93	16.63	81.16	14.26	9.78	.001
Form Perception (P)	103.41	20.98	78.00	19.63	20.34	.001
Clerical Perception (Q)	99.62	14.34	89.52	13.57	8.59	.001

Summary

Hypotheses 1 and 2 dealt with the Occupation Aptitude Patterns identified by the GATB and NATB for secondary level Educable Mentally Retarded and Borderline Intelligence students. In Hypothesis 1 a Pearson Product-Moment Correlation coefficient of .846 was computed showing the relationship between the number of OAP's identified by both tests. In analyzing Hypothesis 2, it was found that the mean number of OAP's identified by the NATB (7.10) was significantly greater than the mean number of OAP's identified by the GATB (3.70).

Hypotheses 3, 4, and 5 dealt with the relationships existing between I.Q. and the various GATB and NATB aptitude scores. Hypothesis 1 showed that all of the GATB and NATB aptitude scores excepting NATB-Q and GATB-Q were significantly related to the full scale I.Q. scores. Hypothesis 4 showed that there was no difference in the relationship between Verbal I.Q. and the cognitive aptitude scores of the GATB and the cognitive aptitude scores of the NATB. Hypothesis 5 showed that a positive relationship existed between Performance I.Q. and all aptitude measures of the GATB and NATB with the exception of Clerical Perception (Q) and Motor Coordination (K) on both tests.

The findings of Hypothesis 6 showed that a significant relationship existed between measured reading socres and aptitude scores for G (Intelligence), V (Verbal Ability),

N (Numerical Ability), and K (Motor Coordination) on both rests. Reading ability is definitely a factor in performance on Aptitudes G, V, and N on both tests.

Additional findings were noted which revealed that the findings of this study concur with previous findings in two respects. First, the NATB yields more OAP's for EMR's than the GATB, and second, this EMR sample scored lower on the NATB-V aptitude measure than on the GATB-V aptitude measure.

Chapter V will discuss the results of the study and the implications and conclusions drawn from it.

CHAPTER V

FINDINGS AND CONCLUSIONS

Introduction

This chapter includes the findings and conclusions based on the outcomes of the study. Included are: 1) a restatement of the problem, 2) findings of the hypotheses tested, 3) implications from findings, 4) conclusions and 5) recommendations for further study.

The Problem

This research was an attempt to determine whether the NATB is a valid instrument for identifying occupational aptitudes of educable mentally retarded and borderline intelligence students. Within the study a determination of the relationship between reading comprehension scores and the GATB and NATB was also made. In addition, the relationship between I.Q. scores and scores on the GATB and NATB was noted.

As stated previously, it is believed that the recognition of vocational aptitude and the provision of occupational training can play a vital role in enabling retarded

and borderline intelligence individuals to emerge in more productive work and to participate more fully in their community as contributing citizens. Although experts agree that most of these individuals are capable of supporting themselves through gainful employment, the retarded suffer much higher rates of joblessness than their counterparts of average intelligence.

For this reason, before the retarded can assume work roles commensurate with their abilities, they need extensive training in preparation for the world of work. At present, however, placement in secondary level vocational training programs is very subjective. It is believed that the NATB can provide an objective measure of vocational aptitude which will lead to improved counseling, training and placement of retarded and borderline intelligence students.

Each research question posed by this study was stated as a hypothesis to be tested. After essential data had been assembled, it was subjected to various statistical analyses which resulted in the following findings by hypotheses:

Finding 1 - A positive relationship existed between the number of OAP's which students obtained on the GATB and the NATB.

Finding 2 - The mean number of OAP's identified by the NATB was significantly higher than the mean number of OAP's identified by the GATB.

Finding 3 - All of the GATB and NATB aptitude scores excepting Q-Clerical Perception on both tests were significantly related to the full scale I.Q.

Finding 4 - There was no difference in the relationship between Verbal I.Q. and the cognitive aptitude scores (G-Intelligence, V-Verbal, S-Spatial, and N-Numerical) obtained by the students on both tests.

Finding 5 - A positive relationship existed between Performance I.Q. and all aptitude measures of the GATB and the NATB with the exception of Q-Clerical Perception and K-Motor Coordination on both tests.

Finding 6 - A significant relationship existed between reading score measures and aptitude scores for G (intelligence), V (verbal ability), N (numerical ability), and K (motor coordination) on both tests.

Because some of these hypotheses are so similar in content, they will be treated as groups in the following segment of the paper which deals with implications which may be derived from the various findings.

Implications from Hypotheses 1 & 2

Several valuable observations may be derived from the findings of Hypotheses 1 & 2. First, it should be noted that the findings for Hypotheses 1 & 2 are consistent with the findings of earlier studies. Huddy, for

example, found that pupils in the higher I.Q. ranges showed more OAP's than those with I.Q.'s in the lower ranges.[1]

Perhaps it should be noted that retarded students with higher I.Q.'s consistently perform better on performance tests than their counterparts with substantially lower I.Q.'s. Among those who have confirmed this fact through research are Wagner and Hawver.[2]

In this study, the NATB failed to identify vast numbers of new OAP's for retarded and borderline intelligence students which its predecessor, the GATB, did not identify. But this is not to say that there were no substantial benefits evident in the use of NATB with this population. For instance, the number of retarded students meeting the criteria for many of the OAP's greatly increased when tested by the NATB. Furthermore, when the NATB was used there was a substantial increase in the percent of students obtaining OAP's in which a G (intelligence), or N (numerical) score was significant. As for the GATB, previous studies by Huddy and Murray concluded that EMR's

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[1]J. A. Huddy, "An Analysis of Occupational Aptitudes of Educable Mentally Retarded and Slow Learning Pupils in Relation to the General Aptitude Test Battery," Unpublished Doctoral Dissertation, (Syracuse University, 1968), p. 60.

[2]Edwin W. Wagner, Dennis A. Hawver, "Correlations Between Psychological Tests and Sheltered Workshop Performance for Severely Retarded Adults," Occupational Information for the Mentally Retarded, (Springfield, Ill.: Charles C. Thomas, 1967), p. 18.

and borderline intelligence students would obtain very few OAP's in which a G, V, or N score was present.[3,4] The findings of this study concur with Huddy and Murray concerning GATB results, as very few students obtained significant numbers of OAP's involving a G, V, or N score. (See Table 6, Chapter IV). However, when tested by the NATB, numerous retarded and borderline intelligence students obtained OAP's in which a G or N score was present. For example, for most of the OAP's beginning with 19 and proceeding to number 28 where the aptitude pattern is comprised of a G (intelligence) aptitude and two of the manipulative, clerical or perceptual aptitudes, 200% more students qualified for these OAP's on the NATB than for the GATB. (See Appendix I). Similarly for OAP's 33 to 43 in which an "N" aptitude is present, there was more than a 300% increase in the number of students obtaining these OAP's on the NATB. (See Appendix I). In contrast, however, for the remaining OAP's 45 to 62 in which no G, V, or N scores were present, there was less than a 50% increase between the number of students obtaining OAP's in the NATB but not in the GATB. In short, scores on the two tests remained rather constant for the performance segments of the tests, but showed a decided increase

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[3]Huddy, Op. Cit., p. 67.

[4]Evelyn Murray, "Developing Potential Skills of the Retarded," Employment Security Review, Vol. 4, 1956, p. 36.

for NATB G and N scores in the cognitive segment of the exams.

For OAP's in which a V (verbal) score was present, there was not a significant increase in the number of students obtaining OAP's when tested by the NATB.

In summary, the findings derived from Hypotheses 1 & 2 imply that counselors and placement officials should seriously consider selecting the NATB in place of the GATB for vocational counseling purposes with retarded and borderline intelligence students. This is because significantly more EMR and borderline intelligence students obtain significantly more OAP's involving G and N scores when tested by the NATB.

Implications from Hypotheses 3, 4, & 5

Historically in the field of education, a certain range of intelligence quotient has been the major criteria for establishing the fact of mental retardation. Most advocates directly associated with the retarded, however, had long realized that I.Q. alone cannot function as the sole criterion for predicting academic, social, or vocational potential as noted in the review of literature, Chapter 2. The American Association for Mental Deficiency was among the first of the major professional bodies to recognize the need to broaden the criteria for defining

mental retardation. For this reason, they introduced the concept of "impairment in adaptive behavior" into their formal definition of retardation.[5] Today many agencies for the retarded use multiple criteria to establish the fact of mental retardation. Even so, I.Q. continues to be a major consideration for prescribing educational placement, vocational counseling, and other decision making purposes. Studies by Appell[6], Elkin[7], McKintosh[8], Gage and Wolfson[9], and Daniels[10] have been reported in the professional literature indicating that the intelligence level of retarded employees is meaningfully related to job performance as well as to general vocational and social adjustment.

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[5]Herbert J. Grossman, Manual on Terminology and Classification in Mental Retardation, American Association on Mental Deficiency, 1973 Revision, p. 147.

[6]M. J. Appell, C. M. Williams, K. N. Fishell, "Significant Factors in Placing Mental Retardates from a Workshop Situation," Personnel and Guidance Journal, 1962, Vol. 41, p. 260.

[7]L. Elkin, "Predicting Performance of the Mental Retardate on Sheltered Workshop and Non-institutional Jobs," American Journal of Mental Deficiency, Vol. 72, 1968, p. 539.

[8]W. J. McKintosh, "Follow-Up Study of 1,000 Non-academic Boys," Journal of Exceptional Children, Vol. 15, 1949, p. 169.

[9]R. M. Gage, I. N. Wolfson, "Four Years of Experience with Day Work Programs at Letchworth Village," American Journal of Mental Deficiency, Vol. 67, 1963, p. 367.

[10]Lloyd Daniels, "Intelligence and Vocational Adjustment," Training School Bulletin, Vol. 70, 1973.

Language handicaps and restricted experience have been shown to have an effect on verbal performance.[11,12] This, in turn, was expected to affect the relationship between verbal I.Q. scores and NATB G, V, N, S scores. The anticipated effect did not materialize, however. That is to say, those students with higher verbal I.Q.'s had correspondingly higher scores on the NATB as well as on the GATB. Therefore, the degree of relationship between verbal I.Q. and GATB subscores was not significantly different from the degree of relationship between verbal I.Q.'s and NATB aptitude subscores G, V, N, S. This finding may be explained in part by the fact that the mean verbal subscores (aptitude V) rendered by the NATB were as low or lower for the participants in this study than those obtained when the same students were tested by the GATB.

When tested for the degree of relationship between mean performance I.Q.'s and GATB/NATB aptitudes subscores, the analysis showed that this relationship was positive with the exception of GATB/NATB Q and K.

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[11] A. E. Alper, "A Comparison of the Wechsler Intelligence Scale for Children and the Arthur Adaptation of the Leiter International Performance Scale with Mental Defectives," American Journal of Mental Deficiency, Vol. 63, 1958, pp. 312-316.

[12] Marion Sandercock, A. J. Butler, "An Analysis of the Performance of Mental Defectives on the Wechsler Intelligence Scale for Children," American Journal of Mental Deficiency, Vol. 57, 1952, p. 412.

Results of a data analysis showed that a positive relationship exists beyond the .005 level between GATB and NATB aptitudes and full scale I.Q. with one exception--GATB and NATB subscore Q (clerical perception). What this degree of correlation implies is that students with higher full scale I.Q. scores will likewise have a higher probability of achieving correspondingly higher NATB and GATB aptitude scores, again with the exception of GATB and NATB subscore Q. (Table 3, Chapter 4)

Because full scale I.Q. is a composite score consisting of verbal and performance measures, a further analysis was deemed necessary. This analysis was made to determine whether the relationship between verbal and performance I.Q. and the GATB and NATB aptitude subscores is significantly different.

The original statement of Hypothesis 4 stated that there would be a higher degree of relationship between verbal I.Q. scores and GATB cognitive aptitude scores (G, V, N, S). It was assumed that when the problems associated with reading for retarded and borderline intelligence students were eliminated, there would be an increase in verbal scores. The mean difference between the verbal I.Q. score and the performance I.Q. score for all who participated in this study was only 5.04. While studies show that retarded students consistently score higher on performance intelligence measures than on verbal intelligence

measures,[13] the spread between the two scores was not very substantial. One should note that other studies (Raben, 1957, Francis and Rarick, 1959) found little relationship between general intelligence of retardates and motor proficiency.[14,15]

Implications from Hypothesis 6

An analysis of the data for Hypothesis 6 revealed that there was a significant relationship between a student's reading ability as indicated by his reading grade level and his G, V, N, and M aptitude scores for both the GATB and the NATB. This relationship was significant beyond the .05 level. Just as the participants with higher I.Q.'s consistently obtained higher GATB/NATB subscores, so did the participants with higher reading achievement scores obtain higher GATB/NATB aptitude subscores. This finding is similar to those of Jacobs who found a statistically significant correlation between

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[13] H. C. Sharp, "A Comparison of Slow Learners' Scores on Three Individual Intelligence Scales," Journal of Clinical Psychology, Vol. 13, 1957, p. 372.

[14] R. J. Francis and G. L. Rarick, "Motor Characteristics of the Mentally Retarded," American Journal of Mental Deficiency, Vol. 63, 1959, p. 809.

[15] H. M. Rabin, "The Relationship of Age, Intelligence, and Sex to Motor Proficiency in Mental Defectives," American Journal of Mental Deficiency, Vol. 62, 1957, p. 514.

intelligence test scores and mean reading grade level.[16] Since reading is highly dependent upon the intellectual level of the child, it may be concluded that the correlation between reading and various intellectual aptitude measures will be consistent.

Conclusions and Recommendations of Study

The major implication deduced from the findings of this study is that the NATB is a more effective instrument for the identification of occupational aptitude patterns for educable mentally retarded and borderline intelligence students than its more commonly used counterpart, the GATB.

This population, nevertheless, scores considerably below the norm for most subtests on both the GATB and NATB. For the general population, the average score for all aptitudes on the GATB and NATB is 100.[17] The mean subscores for the population considered in this study, however, was considerably less except for NATB subscores for form perception and clerical perception.

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[16] J. Jacobs, "A Study of Performance of Slow Learners in the Cincinnati Public Schools on Mental and Achievement Tests," American Journal of Mental Deficiency, Vol. 61, 1957, p. 242.

[17] U. S. Department of Labor, Manual for the General Aptitude Test Battery, Section III: Development, (U.S. Government Printing Office, Washington, D.C., 1970), p. 35.

The lower NATB-V score is consistent with findings of other studies. Dr. Robert Droege of the U. S. Employment Service revealed that disadvantaged and handicapped clients tended to score slightly lower on the NATB Verbal Aptitude than they did on the GATB-V aptitude measure.[18] In conversations with Dr. Droege, it was noted that while the NATB-V subtests eliminate any need for reading, the concepts tested by this segment of the test are nonetheless very difficult for retarded clients. For example, in the Oral Vocabulary Test, one of the V segments of the exam, the student is directed to discriminate between certain words which are presented orally. The examinee must determine if the relationship between the words presented is the "same, opposite, or neither the same nor opposite." When given such a nebulous concept as "neither," retarded pupils are placed at a great disadvantage. Fortunately Dr. Droege noted that this segment of the test was being revised to eliminate this discrepancy. In the revision, a visual cue is presented along with an oral cue. On pilot tests of the revised edition, retarded students have obtained higher verbal scores. What effect this will have upon the total number of OAP's obtained has yet to be determined. Counselors should be alerted to note these results as soon as they are published by the U. S. Training and Employment Service.

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[18] Statement by Robert Droege, telephone interview, March 5, 1973.

There are certain factors which realistically should be considered when choosing between the GATB and NATB. The NATB is more expensive, takes longer to administer, and can be given to fewer students during a single test setting than the GATB. These limitations are minor, however, when contrasted with the benefits inherent in its use.

One significant reason for selecting the NATB over the GATB is the fact that several GATB subtests require a minimum reading proficiency of 7th grade level. Yet, the students in this study had a mean reading grade level of only 3.7. One can readily postulate the interference which this reading deficiency of nearly four grade levels poses to examinees with reading handicaps.

By identifying substantially more OAP's for this population, a vocational counselor is able to discuss many fields of training and placement with his retarded or borderline intelligence client than he can when using GATB results. As Elo and Hendel have aptly stated in the American Journal on Mental Deficiency, "being classified as 'mentally retarded' has implications for what happens in the period of time from acceptance to closure in addition to influencing the outcome of vocational rehabilitation... [Thus] the implementation of a realistic program of vocational assessment of retarded individuals is crucial."[19]

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[19]Margaret R. Elo, Darwin D. Hendel, "Classification as 'Mentally Retarded': A Determinant of Vocational Rehabilitation Outcomes?" American Journal of Mental Deficiency, Vol. 77, No. 2, 1972, p. 198.

The crucial need for realistic programs of vocational assessment for the mentally retarded is not limited to vocational rehabilitation programs. A thorough assessment is also crucial for educational guidance and placement purposes. And, in such vocational programs as those in Vermont, a counselor using NATB OAP's will be able to show reasons for placing EMR's in training programs such as health careers and machine trades instead of assuming that EMR's only have potential for vocational clusters such as food trades or custodial training. Again, by using NATB OAP's, a placement counselor is able to make strong arguments why retarded or borderline intelligence students can be placed in occupational clusters into which many educators have categorically denied their entrance. The rationale for this conclusion is explained in this manner. In any vocational field there are highly skilled, semi-skilled and unskilled job stations. If all jobs that make up a trade are carefully analyzed, it will be revealed that the same skills needed to perform in less skilled job slots are also needed by those performing at higher levels of employment. In addition, it will be noted that certain tasks in a trade are performed by almost all workers while others are performed by only a few highly skilled workers. This implies that people training for a variety of job stations within a job cluster could begin their training together but exit at different points in their training. This should be the case with training mentally

retarded and borderline intelligence students. They could benefit from the same training everyone else receives initially; the EMR would simply exit sooner if necessary. Several NATB OAP's indicate that retarded and borderline intelligence students have sufficient aptitude to participate in training programs which up to this time were considered off limits to such individuals.

Ideally, one's vocational interests should be a principle criterion for determining acceptance into desired vocational training programs. Realistically, however, in many vocational schools where the student enrollment may exceed a thousand students, one's interests may be totally ignored by placement personnel who must consider the number of available slots for any program above the interests of students seeking acceptance into the programs. This situation often results in the practice of admitting only those students with the highest potential into the most popular programs. Subsequently, in the semester before they become eligible for vocational training, students are given batteries of tests supposedly to determine their potential for success in the programs of their choice. Yet, in fact, in many schools these test results are used to establish a hierarchy in which those with the highest scores are selected for placement in the most popular programs. Given such circumstances, any test that enhances the test results obtained by retarded and borderline intelligence students has additional merit.

Many factors, in addition to aptitude appraisal, determine the ultimate degree of success and satisfaction an individual can derive from participation in the world of work. Among the factors that may influence job success are these: interests, physical capacity, personality, social skills, acquired skills and extent of education and training. Obviously one cannot conclude that a student will or will not succeed in a chosen occupation on the basis of a few scores derived from an aptitude test. Even so, given the effect that scores may have on counselors and students alike, one should not overlook the fact that the NATB yields results which can be viewed more positively than scores rendered by the GATB.

In the original statement of the thesis problem, it was noted that a reliable aptitude measure is needed to add to the other considerations that ultimately are used in vocational counseling and placement for retarded and borderline intelligence students. The results of this study indicate that the NATB can identify more occupational aptitude patterns for EMR and borderline intelligence students and should be considered by counselors who are selecting testing instruments.

Recommendations for Further Study

This study has identified additional areas which appear worthy of further research. The first and most obvious need

is to determine if more OAP's for retarded and borderline intelligence students are rendered by the NATB once the verbal segment of the test has been revised. In addition, it is suggested that studies be conducted to:

1.) determine the degree of success as indicated by grades and other evaluative means which retarded students who achieve certain OAP's actually experience in corresponding vocational training classes.

2.) determine if students who acquire certain OAP's are more successful in these job areas than those individuals placed in jobs for which they failed to meet the corresponding OAP's.

3.) determine if the NATB could be used in conjunction with a vocational interest survey to predict success in vocational training or employment.

4.) determine the NATB norms of EMR's who have proven successful in jobs corresponding with various OAP's.

BIBLIOGRAPHY

Abel, Theodore. "Tested Mentality as Related to Success in Skilled Trade Training," Archives of Psychology. Vol. 77, 1925.

Alper, A. "A Comparison of the Wechsler Intelligence Scale for Children and the Arthur Adaptation of the Leiter International Performance Scale with Mental Defectives," American Journal of Mental Deficiency, Vol. 63, 1958.

Appell, M. J., C. M. Williams, and K. N. Fishell. "Significant Factors in Placing Mental Retardates from a Workshop Situation," Personnel and Guidance Journal, Vol. 41, 1962.

Bird, V. H. "A Study of the Correlation of General Intelligence and Progress in Learning Machine Shop Work as Related to the Problems of Educational Guidance," Industrial Education Magazine, Vol. 24, 1922.

Carbuhn, Wayne, and Ivan Wells. "Use of Nonreading Aptitude Tests (NATB) for Selecting Mental Retardates for Competitive Employment," Measurement and Evaluation in Guidance, Vol. 5, No. 4, (January 1973).

Chaffine, Jerry D., Charles R. Spellman, C. Edward Regan, and Roxana Davison. "Two Follow-up Studies of Former Educable Mentally Retarded Students from the Kansas Work-Study Project," Exceptional Children, (Summer 1971).

Clark, Gary M. Prevocational Evaluation in Work Study Programs: An Expanded View, (Champaign, Illinois: University of Illinois).

Cowdery, K. M. "Measures of General Intelligence as Indices of Success in Trade Learning," Journal of Applied Psychology, 1920.

Culhane, Margaret. "The General Aptitude Test Battery: Its Availability and Use," Vocational Guidance Quarterly, Vol. 13, No. 1, 1964.

Daniels, Lloyd. "Intelligence and Vocational Adjustment," Training School Bulletin, Vol. 70, 1973.

Dinger, Jack C. "Post-school Adjustment of Former Educable Retarded Pupils," Exceptional Children, Vol. 27, 1961.

Doeer, Joseph, and John Ferguson. "The Selection of Vocational Technical Students " The Vocational Guidance Quarterly, Vol. 17, No. 1, (September 1968).

Droege, Robert C. "Effects of Aptitude - Score Adjustments by Age Curves on Prediction of Job Performance," Journal of Applied Psychology, Vol. 51, No. 2, 1967.

Droege, Robert C. "GATB Norms for Lower High School Grades," Personnel and Guidance Journal, Vol. 39 (September 1960).

Droege, Robert C. Phone Conversation.

Droege, Robert C. and John Hawk. "A Factoral Investigation of Nonreading Aptitude Tests," Proceedings, 78th Annual Convention of the American Personnel and Guidance Association, 1970.

Droege, Robert C., W. Showler, S. Bemis, and J. Hawk. "Development of a Nonreading Edition of the General Aptitude Test Battery," Measurement and Evaluation in Guidance, Vol. 3, No. 1, (Spring, 1970).

Dunn and Markwardt. Manual for the Peabody Individual Achievement Test.

Edwards, Allen L. Experimental Design in Psychological Research. 4th Edition. New York, N.Y.: Holt, Rinehart & Winston, 1971, C1972.

Elkin, L. "Predicting Performance of the Mental Retardate on Sheltered Workshop and Non-institutional Jobs," American Journal of Mental Deficiency, Vol. 72, 1968.

Elo, Margaret R. and Darwin D. Hendel. "Classification as 'Mentally Retarded': A Determinant of Vocational Rehabilitation Outcomes?" American Journal of Mental Deficiency, Vol. 77, No. 2, 1972.

Fernald, W. E. "After-Care Study of Patients Discharged From Waverly Over a Period of 25 Years," Ungraded, 1919.

Francis, R. J. and G. L. Rarick. "Motor Characteristics of the Mentally Retarded," American Journal of Mental Deficiency, Vol. 63, 1959.

Gage, R. M. and I. N. Wolfson. "Four Years of Experience with Day Work Programs at Letchworth Village," American Journal of Mental Deficiency, Vol. 67, 1963.

Gardner, Eric F. and others. Manual for the Stanford Achievement Test, High School Battery. New York, N.Y.: Harcourt, Brace & World, Inc., 1965.

Ghiselli, E. E. and C. W. Brown. "The Effectiveness of Intelligence Tests in the Selection of Workers," Journal of Applied Psychology, XXXII, 1948.

Grossman, Herbert J., M.D. (Ed.). Manual on Terminology and Classification in Mental Retardation. American Association on Mental Deficiency, 1973 Revision.

Guilford, J. P. and W. S. Zimmerman. "The Guildord and Zimmerman Aptitude Survey," Journal of Applied Psychology, XXXII, 1948.

Huddy, J. A. "An Analysis of Occupational Aptitudes of Educable Mentally Retarded and Slow Learning Pupils in Relation to the General Aptitude Test Battery," Unpublished Doctoral Dissertation, Syracuse University, 1968.

Hurley, Roger L. Poverty and Mental Retardation: A Causal Relationship. New York, N.Y.: Random House, 1969.

Intersall, R. W. and H. J. Peters. "Predictive Indices of the GATB," Personnel and Guidance Journal, Vol. 44, 1966.

Jacobs, J. "A Study of Performance of Slow Learners in the Cincinnati Public Schools on Mental and Achievement Tests," American Journal of Mental Deficiency, Vol. 61, 1957.

Johnson, B. S. "A Study of Cases Discharged From Laconia State School from July 1, 1924 to July 1, 1934," American Journal of Mental Deficiency, Vol. 50, 1946.

Johnson, G. Orville. Education for the Slow Learners. Englewood Cliffs, N.J.: Prentice Hall, 1963.

Kapes, Jerome T. "Exploring the Use of the GATB with Vocational Technical Bound Ninth Grade Boys," ERIC ED, (January 1969).

Masland, R. L. "The Prevention of Mental Retardation: A Survey of Research," American Journal of Mental Deficiency, Vol. 62, 1958.

McKintosh, W. J. "Follow-Up Study of 1,000 Non-academic Boys," Journal of Exceptional Children, Vol. 15, 1949.

Murray, Evelyn. "Developing Potential Skills of the Retarded," Employment Security Review, Vol. 4, 1956.

Murray, Evelyn. "The Vocational Potential of the Retarded," Vocational Guidance Quarterly, Vol. 7, 1958.

Neuhaus, Edmund C. "Training the Mentally Retarded for Competitive Employment," Exceptional Children, (May 1967).

Peterson, Richard and Edna Jones. Guide to Jobs for the Mentally Retarded. Pittsburg, Penn.: American Institute for Research, 1964.

Phelps, W. R. "Attitudes Related to the Employment of Mentally Retarded," American Journal of Mental Deficiency, Vol 69, 1965.

President's Committee on Mental Retardation. The Edge of Change. Washington, D.C.: U.S. Government Printing Office, March 1968.

President's Panel on Mental Retardation, The. A Proposed Program for National Action to Combat Mental Retardation. October, 1962.

President's Panel on Mental Retardation, The. U.S. Mental Retardation: A National Plan for a National Problem. Washington, D.C.: U.S. Government Printing Office, August 1963.

Rabin, H. M. "The Relationship of Age, Intelligence, and Sex to Motor Proficiency in Mental Defectives," American Journal of Mental Deficiency, Vol. 62, 1957.

Rabinoff, Allan. A Survey of Attitudes of Mothers with Mentally Retarded Children. Milwaukee, Wisconsin: University of Wisconsin, August 1968.

Reissman, Frank. The Culturally Deprived Child. New York, N.Y.: McGraw Hill, Inc., 1965.

Robinson, Halbert B. and Nancy M. Robinson. The Mentally Retarded Child. New York, N.Y.: McGraw Hill, Inc., 1965.

Roley, R. W. "A Study of Patients Discharged from the Rome State School for the Twenty-year Period Ending December 31, 1924," Journal of Psycho-Asthenics, Vol. 34, 1929.

Samuelson, C. E. "The General Aptitude Test Battery in Predicting Success of Vocational School Students," Journal of Educational Research, Vol. 50, 1956.

Sandercock, Marion and A. J. Butler. "An Analysis of the Performance of Mental Defectives on the Wechsler Intelligence Scale for Children," American Journal of Mental Deficiency, Vol. 57, 1952.

Sharp, H. C. "A Comparison of Slow Learners' Scores on Three Individual Intelligence Scales," Journal of Clinical Psychology, Vol. 13, 1957.

Super, D. E. "The Use of Multifactor Test Batteries in Guidance," Personnel & Guidance Journal, 1956.

U. S. Department of Health, Education and Welfare. Mental Retardation: Activities of the U. S. Department of Health, Education and Welfare. July 1963.

U. S. Department of Labor. Guide to the Use of the General Aptitude Test Battery: Section III, Development. Washington, D.C.: U.S. Government Printing Office, 1962.

U. S. Department of Labor. Manual for the General Aptitude Test Battery, Section III: Development. Washington, D.C.: U.S. Government Printing Office, 1967.

U. S. Department of Labor. Manual for the General Aptitude Test Battery, Section III: Development. Washington, D.C.: U. S. Government Printing Office, 1970.

U. S. Department of Labor. Manual for the Nonreading Aptitude Test Battery: Form A. Washington, D.C.: U. S. Government Printing Office, 1970.

U. S. Employment Service. Manual for the Nonreading Aptitude Test Battery, Section I. Washington, D.C.: U. S. Government Printing Office, 1970.

U. S. Employment Service, Department of Labor. Development of a Nonreading Edition of the General Aptitude Test Battery. U. S. Employment Service Test Research Report No. 23. Washington, D.C.: U. S. Government Printing Office, November 1968.

U. S. Employment Service, Manpower Administration. Personal correspondence between Dr. Robert J. Brown, Associate Administrator, and the writer. n.d.

Wagner, Edwin and Dennis Hawver. "Correlations Between Psychological Tests and Sheltered Workshop Performance for Severely Retarded Adults," Occupational Information for the Mentally Retarded, Springfield, Illinois: Charles C. Thomas, 1967.

Wechsler, Manual for the Wechsler Intelligence Scale for Children, 1949.

Wolfensberger, W. "Vocational Preparation and Occupation," Mental Retardation, Chicago: Aldine, 1967.

Wysong, Eugene H. "The Use of the GATB in Grades 9 & 10," Personnel & Guidance, Vol. 43, (January 1965).

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APPENDIX A

AGREEMENT FOR THE RELEASE OF UNITED STATES TRAINING AND EMPLOYMENT SERVICE TEST MATERIALS FOR RESEARCH PURPOSES

It is hereby agreed between William D. Halloran,
(name of Research Organization)
Education Consultant, Dept. of Education - State Office Bldg., Montpelier, Vt.
(Address)
(hereinafter referred to as the Organization), and the Vermont State Employment Service (hereinafter referred to as the Releasing Agency) that the Releasing Agency will furnish specified USTES test materials to the Organization for the purpose and under the conditions stated below:

1. Purpose of study: Determination of NATB as a valuable counseling tool for educable mentally retarded high school students.
(Attach copy of plan describing specifically the procedures to be used in conducting the study.)

2. Name of person(s) conducting research William D. Halloran.

3. The Organization agrees to use the test materials for research purposes only.

4. The Organization agrees not to sell or otherwise release the test materials.

5. The Organization agrees to furnish the Releasing Agency with complete data and results of all studies in which USTES test materials are used, including copies of reports intended for publication.

6. The Organization is permitted to publish the findings of any research in which USTES test materials are used.

7. Reports of analysis of test research data which may not be intended for publication are to be made available to the Releasing Agency.

8. The agreement will remain in effect for a period of one year until October 1, 1974 at which time renewal will be considered. It may be canceled by mutual consent or by the Releasing Agency if the conditions of the agreement are violated.

9. It is understood that the Releasing Agency is under no obligation to authorize the implementation of any recommendations involving the release of Employment Service tests to the Organization for operational use.

10. The Organization agrees to return all USTES test apparatus and unused test materials to the Releasing Agency whenever this agreement is canceled.

Signature William D. Halloran 9/25/72
(Organization representative) (Date)

Signature William D. Kelley 9/25/72
(State Employment Service representative) (Date)

Signature Geoffrey Dyer
(Regional Manpower Administrator) (Date)

APPENDIX B

U.S. DEPARTMENT OF LABOR
MANPOWER ADMINISTRATION
WASHINGTON, D.C. 20210

AUG 23 1973

Mr. William D. Halloran
Special Education Consultant
State of Vermont
Department of Education
Montpelier, Vermont 05602

SPECIAL EDUCATION
AUG 27 1973
RECEIVED

Dear Mr. Halloran:

Thank you for your letter of August 9, 1973 regarding your thesis, which involves research on the GATB and NATB with retarded students. We are pleased at your interest in this important area of research, and will assist in any way we can.

There has been some GATB and NATB research on retarded groups. Copies of articles and references to this research are enclosed. The most active researchers in this area are Wayne Carbohn and Ivan Wells. You may want to correspond with them about additional research they may have done which has not been published.

Comments on your research proposal are as follows:

1. Form B of the GATB, B-1002 may be more appropriate than Form A because the NATB tests which utilize GATB items were developed from the Form A tests. Thus, use of GATB, B-1002B would help eliminate GATB-NATB practice effects.

2. We suggest that, if possible, the sample be restricted to individuals who are at least age 16. The validity of score adjustments for maturation required for younger students would be questionable for this type of sample, particularly in the case of the NATB.

Comments on your list of test material needs and possibilities of obtaining help in meeting these needs are as follows:

1. Since we have an interest in the research you are doing, we would be willing to provide you with a sizable portion of the NATB test booklets, test administration blow-ups, and cut-outs for the Three Dimensional Space Test. These materials will be provided to you after a release agreement for the research is made. (As indicated by Mr. Robert Droege in his August 16 telephone call to you, it is necessary that a formal release agreement for research be made between you the Vermont Department of Employment Security.)

2. You may be able to borrow GATB test booklets and GATB apparatus from the Vermont Department of Employment Security or high schools using the GATB.

Sincerely,

Robert J. Brown

ROBERT J. BROWN
Associate Manpower Administrator for
U.S. Employment Service

Enclosures

State of Vermont
Department of Education
Vocational-Technical Education
Montpelier

Memo No: ADM-74-12 (T)

To: Superintendents of Schools having Diversified Occupations Programs
Area Vocational Center Directors having Diversified Occupations Programs

From: Cola D. Watson, Director
Vocational-Technical Education

Date: October 2, 1973

Subject: Research Project in Diversified Occupations Programs

I. INTRODUCTION

The Division of Vocational-Technical Education, Department of Education has funded a research project to determine if the Nonreading Aptitude Test Battery (NATB) can provide useful information to be used in the vocational counseling of educable mentally retarded students in Diversified Occupations programs.

II. STAFF INVOLVEMENT

William Halloran, Special Education Consultant for Vocational Programs for the Handicapped, will be working with local vocational guidance coordinators and Diversified Occupations staff members in conducting the study.

III. PROCEDURE

Phase I. The testing and data collection phase will be in operation from September to December.

Phase II. The data analysis phase will be in operation from January to March.

Phase III. The dissemination phase will take place during the month of April.

IV. COOPERATING AGENCIES

-- Area Vocational Centers having Diversified Occupations Programs
-- Vermont Department of Employment Security
-- Vermont Department of Education, Division of Vocational-Technical Education
-- Vermont Department of Education, Special Educational and Pupil Personnel Services

V. EXPECTED OUTCOMES

To determine if the NATB can provide valuable vocational counseling information for students with limited verbal skills.

V. ENCLOSURES

A detailed description of the research project is in the attached copy of the proposal.

FOR INFORMATION ONLY

APPENDIX D

DESCRIPTIONS OF TESTS IN THE GATB, B-1002

The tests in B-1002 are described below. The aptitude or aptitudes measured by each test follow each definition.

Part 1--Name Comparison

This test consists of two columns of names. The examinee inspects each pair of names, one in each column, and indicates whether the names are the same or different. Measures Clerical Perception.

Part 2--Computation

This test consists of a number of arithmetic exercises requiring the addition, subtraction, multiplication, or division of whole numbers. Measures Numerical Aptitude.

Part 3--Three-Dimensional Space

This test consists of a series of exercises containing a stimulus figure and four drawings of three-dimensional objects. The stimulus figure is pictured as a flat-piece of metal which is to be either bent, or rolled, or both. Lines indicate where the stimulus figure is to be bent. The examinee indicates which one of the four drawings of three-dimensional objects can be made from the stimulus figure. Measures Intelligence and Spatial Aptitude.

Part 4--Vocabulary

This test consists of sets of four words. The examinee indicates which two words have either the same or opposite meanings. Measures Intelligence and Verbal Aptitude.

Part 5--Tool Matching

This test consists of a series of exercises containing a stimulus drawing and four black-and-white drawings of simple shop tools. The examinee indicates which of the four black-and-white drawings is the same as the stimulus drawing. Variations exist only in the distribution of black and white in each drawing. Measures Form Perception.

Part 6--Arithemetic Reason

This test consists of a number of arithmetic problems expressed verbally. Measures Intelligence and Numerical Aptitude.

Part 7--Form Matching

This test consists of two groups of variously shaped line drawings. The examinee indicates which figure in the second group is exactly the same size and shape as each figure in the first or stimulus group. Measures Form Perception.

Part 8--Mark Making

This test consists of a series of squares in which the examinee is to make three pencil marks, working as rapidly as possible. The marks to be made are short lines, two vertical and the third a horizontal line beneath them. Measures Motor Coordination.

Part 9--Place

The equipment used for this test and for Part 10 consists of a rectangular pegboard divided into two sections, each section containing 48 holes. The upper section contains 48 cylindrical pegs. The examinee removes the pegs from the holes in the upper part of the board and

inserts them in the corresponding holes in the lower part of the board, moving two pegs simultaneously, one in each hand. This performance is done three times, with the examinee working rapidly to move as many of the pegs as possible during the time allowed for each of the three trials. Measures Manual Dexterity.

Part 10--Turn

The equipment described under Part 9 is also used for this test. For Part 10 the lower section of the board contains the 48 cylindrical pegs. The examinee removes a wooden peg from a hole, turns the peg over so that the opposite end is up, and returns the peg to the hole from which it was taken, using only his preferred hand. The examinee works rapidly to turn and replace as many of the 48 cylindrical pegs as possible during the time allowed. Three trials are given for this performance. Measures Manual Dexterity.

Part 11--Assemble

The equipment used for this test and for Part 12 consists of a small rectangular board (Finger Dexterity Board) containing 50 holes, and a supply of small metal rivets and washers. The examinee takes a small metal rivet from a hole in the upper part of the board with his preferred hand and at the same time removes a small metal washer from a vertical rod with the other hand; examinee puts the washer on the rivet, and inserts the assembled piece into the correspoinding hole in the lower part of the board using only his preferred hand. The examinee works rapidly to move and replace as many rivets and washers as possible during the time allowed. Measures Finger Dexterity.

Part 12--Disassemble

The equipment used for this test is the same as that described for Part 11. The examinee removes the small metal rivet of the assembly from a hole in the lower part of the board, slides the washer to the bottom of the board, puts the washer on the rod with one hand and the rivet into the corresponding hole in the upper part of the board with the other (preferred) hand. The examinee works rapidly to move and replace as many rivets and washers as possible during the time allowed. Measures Finger Dexterity.

Source: United States Department of Labor, Manual for the General Aptitude Test Battery, Section III; Development, (U.S. Government Printing Office, Washington, D.C.), p. 15.

APPENDIX E

DESCRIPTION OF TESTS IN THE NATB

The following is a brief description of tests which make up the Nonreading Aptitude Test Battery:

1. Picture-Word Matching (Test A). A 42-item test in which the examinee must determine which of five pictures associates best with a stimulus word read by the examiner. These items are in order of increasing difficulty for low education individuals.

2. Oral Vocabulary (Test B). Contains 45 items which must be read to the examinee. The examinee must decide whether the two words are the same, opposite, or different. These items are in order of increasing difficulty for low education individuals.

3. Coin Matching (Test C). A 63-item test in which the examinee must indicate whether two groups of coins have the same value.

4. Matrices (Test D). Contains 29 matrix type items which are in order of increasing difficulty for low education individuals.

5. Tool Matching (Test E). This test consists of a series of exercises containing a stimulus drawing and four black-and-white drawings of simple shop tools. The examinee indicates which of the four black-and-white drawings is the same as the stimulus drawing. Variations exist only in the

distribution of black and white in each drawing. Contains 48 items.

6. Three-Dimensional Space (Test F). This test consists of a series of exercises containing a stimulus figure and four drawings of three-dimensional objects. The stimulus figure is pictured as a flat piece of metal which is to be either bent, or rolled, or both. Lines indicate where the stimulus figure is to be bent. The examinee indicates which one of the four drawings of three-dimensional objects can be made from the stimulus figure. Contains 40 items.

7. Form Matching (Test G). This test consists of two groups of variously shaped line drawings. The examinee indicates which figure in the second group is exactly the same size and shape as each figure in the first or stimulus group. Contains 48 items.

8. Coin Series (Test H). Three subtests, of which Part I has 72 items, Parts II and III each have 46 items. The examinee must mentally manipulate the coins according to the assigned system.

9. Name Comparison (Test I). This test consists of two columns of names. The examinee inspects each pair of names, one in each column, and indicates whether the names are the same or different. Contains 150 items.

10. Mark Making (GATB Part 8). This test consists of a series of squares in which the examinee is to make three pencil marks, working as rapidly as possible. The marks to be made are short lines,

two vertical and the third a horizontal line beneath them.

11. Place (GATB Part 9). The equipment used for this test and Turn (GATB Part 10) consists of a rectangular wooden board (Pegboard) divided into two sections, each section containing 48 holes. The upper section contains 48 cylindrical wooden pegs. The examinee removes the wooden pegs from the holes in the upper part of the board and inserts them in the corresponding holes in the lower part of the board, moving two pegs simultaneously, one in each hand. This performance is done three times, with the examinee working rapidly to move as many of the pegs as possible during the time allowed for each of the three trials.

12. Turn (GATB Part 10). The equipment described under Place is also used for this test. For Turn the lower section of the board contains the 48 pegs. The examinee removes a peg from a hole, turns the peg over so that the opposite end if up, and returns the peg to the hole from which it was taken, using only his preferred hand. The examinee works rapidly to turn and replace as many of the 48 pegs as possible during the time allowed. Three trials are given.

13. Assemble (GATB Part 11). The equipment used for this test and for Disassemble (GATB Part 12) consists of a small rectangular board (Finger Dexterity Board) containing 50 holes, and a supply of small metal rivets and washers. The examinee takes a small metal rivet from a hole

in the upper part of the board with his preferred hand and at the same time removes a small metal washer from a vertical rod with the other hand; examinee puts the washer on the rivet, and inserts the assembled piece into the corresponding hole in the lower part of the board using only his preferred hand. The examinee works rapidly to move and replace as many rivets and washers as possible during the time allowed.

14. Disassemble (GATB Part 12). The equipment for this test is the same as that described for Assemble. The examinee removes the small metal rivet of the assembly from the hole in the lower part of the board, slides the washer to the bottom of the board, puts the washer on the rod with one hand and the rivet into the corresponding hole in the upper part of the board with the other (preferred) hand. The examinee works rapidly to move and replace as many rivets and washers as possible during the time allowed.

Source: U.S. Department of Labor, Manual for the Nonreading Aptitude Test Battery, Section I, Administration and Scoring, (U.S. Government Printing Office, Washington, D.C.), p. 3.

APPENDIX F

DEFINITIONS OF APTITUDES MEASURED IN GATB AND THE NATB

The nine aptitudes measured by the GATB and the NATB are defined below. The letter used as the symbol to identify each aptitude precedes each aptitude name. The test(s) of the GATB measuring each aptitude follow each definition. The aptitude definitions are based on the factor analysis studies. Hence, some of the aptitude definitions do not correspond exactly to the definitions of the test(s) which measure them. The difinitions describe the factor being measured rather than the specific test(s) chosen to represent the factor.

Aptitude G--Intelligence

General learning ability. The ability to "catch on" or understand instructions and underlying principles; the ability to reason and make judgments. Closely related to doing well in school.

Aptitude V--Verbal Aptitude

The ability to understnad meaning of words and to use them effectively. The ability to comprehend language, to understand relationships between words and to understand meanings of whole sentences and paragraphs.

Aptitude N--Numerical Aptitude

Ability to perform arithmetic operations quickly and accurately.

Aptitude S--Spatial Aptitude

Ability to think visually of geometric forms and to comprehend the two-dimensional representation of three dimensional objects. The ability to recognize the relationships resulting from the movement of objects in space.

Aptitude P--Form Perception

Ability to perceive pertinent detail in objects or in pictorial or graphic material. Ability to make visual comparisons and discriminations and see slight differences in shapes and shadings of figures and widths and lengths of lines.

Aptitude Q--Clerical Perception

Ability to perceive pertinent detail in verbal or tabular material. Ability to observe differences in copy, to proofread words and numbers, and to avoid perceptual errors in arithmetic computation. A measure of speed of perception which is required in many industrial jobs even when the job does not have verbal or numerical content.

Aptitude K--Motor Coordination

Ability to coordinate eyes and hands or fingers rapidly and accurately in making precise movements with speed. Ability to make a movement response accurately and swiftly.

Aptitude F--Finger Dexterity

Ability to move the fingers, and manipulate small objects with the fingers, rapidly or accurately.

Aptitude M--Manual Dexterity

Ability to move the hands easily and skillfully. Ability to work with the hands in placing and turning

motions.

Source: United States Department of Labor, Manual for the General Aptitude Test Battery, Section III: Development, (U.S. Government Printing Office, Washington, D.C.), p. 16.

APPENDIX G

PERCENTILE EQUIVALENTS OF APTITUDE OR STANDARD SCORES

Percentile Equivalents of Adult Scores. The GATB was standardized on a general working population sample of 4,000 individuals. The standardization procedure is presented in Section III of the Manual for the GATB. An aptitude score of 100 is average for the general working population, and the standard deviation of the distribution of scores for each aptitude is 20. Thus, a score of 100 approximates the 50th percentile for the general working population; a score of 80 is one standard deviation below the average and approximates the 16th percentile for the general working population (about 16 percent of the general working population fall below that score, whereas about 84 percent make that score or higher). Similarly, a score of 120 is one standard deviation above the average and approximates the 84th percentile; and a score of 140, which is two standard deviations above the average, approximates the 98th percentile (about 98 percent of the general working population have scores below 140).

Percentile Equivalents of 9th- and 10th-Grade Scores. Aptitude scores in the 9th and 10th grades average lower than adult scores. Projected percentile equivalents of the scores of 9th- and 10th-graders have been derived from the distribution of adult-level scores students can be expected to make as 12th-graders. Tenth-grade percentile

scores may be interpreted in the same way that an adult's percentile scores. That is, the percentile scores for adults, 9th-graders, and 10th-graders provide indications of how students can be expected to compare with adults in the general working population at the time they achieve their adult level aptitude scores.

Source: U. S. Department of Labor, Manual for the General Aptitude Test Battery, Section II, Norms, p. 5.

APPENDIX G (Continued)

Projected Percentile Equivalents of 10th-Grade Aptitude or Standard Scores
(Based on GATB Longitudinal Maturation Study)

10th grade aptitude scores	Percentile equivalents* of GATB aptitudes								
	G	V	N	S	P	Q	K	F	M
145	99	99	99	99	99	99	99	99	99
140	99	99	99	98	98	99	99	99	99
135	98	98	98	97	96	98	98	98	98
130	96	96	96	95	94	96	97	96	96
125	93	94	94	91	90	93	95	94	94
120	88	89	90	86	85	89	91	90	90
115	83	84	85	80	80	84	86	84	85
110	76	76	79	73	73	76	80	77	79
105	67	67	71	62	64	67	73	69	71
100	58	58	62	52	56	58	64	60	62
95	48	46	50	42	46	48	52	50	52
90	38	36	40	33	36	38	42	40	42
85	29	26	31	24	29	27	33	31	33
80	21	18	23	16	21	20	24	23	24
75	15	12	16	11	15	14	17	16	17
70	10	7	11	7	11	9	12	11	12
65	6	4	7	4	7	5	7	7	7
60	4	2	4	2	4	3	4	4	4
55	2	1	2	1	3	2	3	2	3
50	1	1	1	1	1	1	1	1	1
45	1	1	1	1	1	1	1	1	1

*These percentile equivalents for 10th-grade students are derived from the distribution of adult-level scores which the students could be expected to make as 12th-graders.

APPENDIX H

Table 13

GATB

Grade 10

Minimum Aptitude Scores for Occupational Aptitude Patterns

Occupational Aptitude Pattern		Minimum Aptitude Scores								
Number	Pattern	G	V	N	S	P	Q	K	F	M
All H's		120	101	109	113	97	101	89	95	94
No H's		70	77	74	74	69	76	63	69	68
1	GNS	120		109	113					
2	GVN	106	101	100						
3	GVS	106	101		99					
4	GNQ	106		104			101			
5	GNS	101		100	104					
6	GSK	101			109			89		
7	GSP	101			94	97				
8	GQK	101					96	84		
9	GVQ	96	101				91			
10	GVS	96	97		89					
11	GVQ	96	88				86			
12	GVM	96	88							89
13	GPQ	96				97	96			
14	GNQ	91		85			91			
15	GSM	91			94					79
16	GVN	86	92	85						
17	GVQ	86	88				96			
18	GVK	86	78					79		
19	GSF	81			84				75	
20	GQF	81					96		85	
21	GKM	81						64		69
22	GVQ	76	78				77			
23	GNQ	76		75			77			
24	GPQ	76				81	86			
25	GPK	76				86		74		
26	GKM	76						84		74
27	GKF	71						84	95	
28	GFM	71							70	74
29	VQK		88				96	84		
30	VNK		83	80				79		
31	NSQ			100	104		96			

Table 13 (Continued)

GATB
Grade 10

Minimum Aptitude Scores for Occupational Aptitude Patterns—*Continued*

Occupational Aptitude Pattern		Minimum Aptitude Scores								
Number	Pattern	G	V	N	S	P	Q	K	F	M
All H's		120	101	109	113	97	101	89	95	94
No H's		70	77	74	74	69	76	63	69	68
32	NFM			94					75	89
33	NPQ			90		97	101			
34	NSP			85	94	86				
35	NSF			80	94				75	
36	NPM			80		92				84
37	NSM			75	94					79
38	NSK			75	84			74		
39	NQK			75			91	69		
40	NQM			75			82			74
41	SQK				94		82	69		
42	SPM				89	81				79
43	SPF				84	86			80	
44	SPK				80	81		84		
45	SQF				80		86		75	
46	SKM				80			74		74
47	SFM				80				75	79
48	SPM				75	70				69
49	PFM					86			80	69
50	PKM					81		79		94
51	PKM					81		74		74
52	PQM					76	86			74
53	PFM					76			75	89
54	PKF					70		79	85	
55	PKM					70		69		69
56	PFM					70			75	74
57	QKM						91	89		79
58	QKF						91	84	70	
59	QFM						86		75	79
60	QKM						82	74		84
61	KFM							84	80	84
62	KFM							74	70	69

APPENDIX I

Table 14

The Number of OAP's and the Percent of Increase of Students Obtaining NATB OAP's Over GATB OAP's

Occupational Aptitude Pattern Number	Pattern	GATB	NATB	% of Increase Over GATB
1	GNS	0	0	0
2	GVN	0	0	0
3	GVS	0	0	0
4	GNQ	0	0	0
5	GNS	0	0	0
6	GSK	0	0	0
7	GSP	0	0	0
8	GQK	0	0	0
9	GVQ	0	0	0
10	GVS	0	2	200
11	GVQ	0	3	300
12	GVM	0	2	200
13	GPQ	0	1	100
14	GNQ	1	5	400
15	GSM	0	4	400
16	GVN	0	4	400
17	GVQ	0	1	100
18	GVK	1	4	300
19	GSF	5	14	180
20	GQF	1	5	400
21	GKM	2	14	600
22	GVQ	14	24	71
23	GNQ	9	30	233
24	GPQ	14	42	129
25	GPK	8	20	150
26	GKM	4	8	100

Table 14 (Continued)

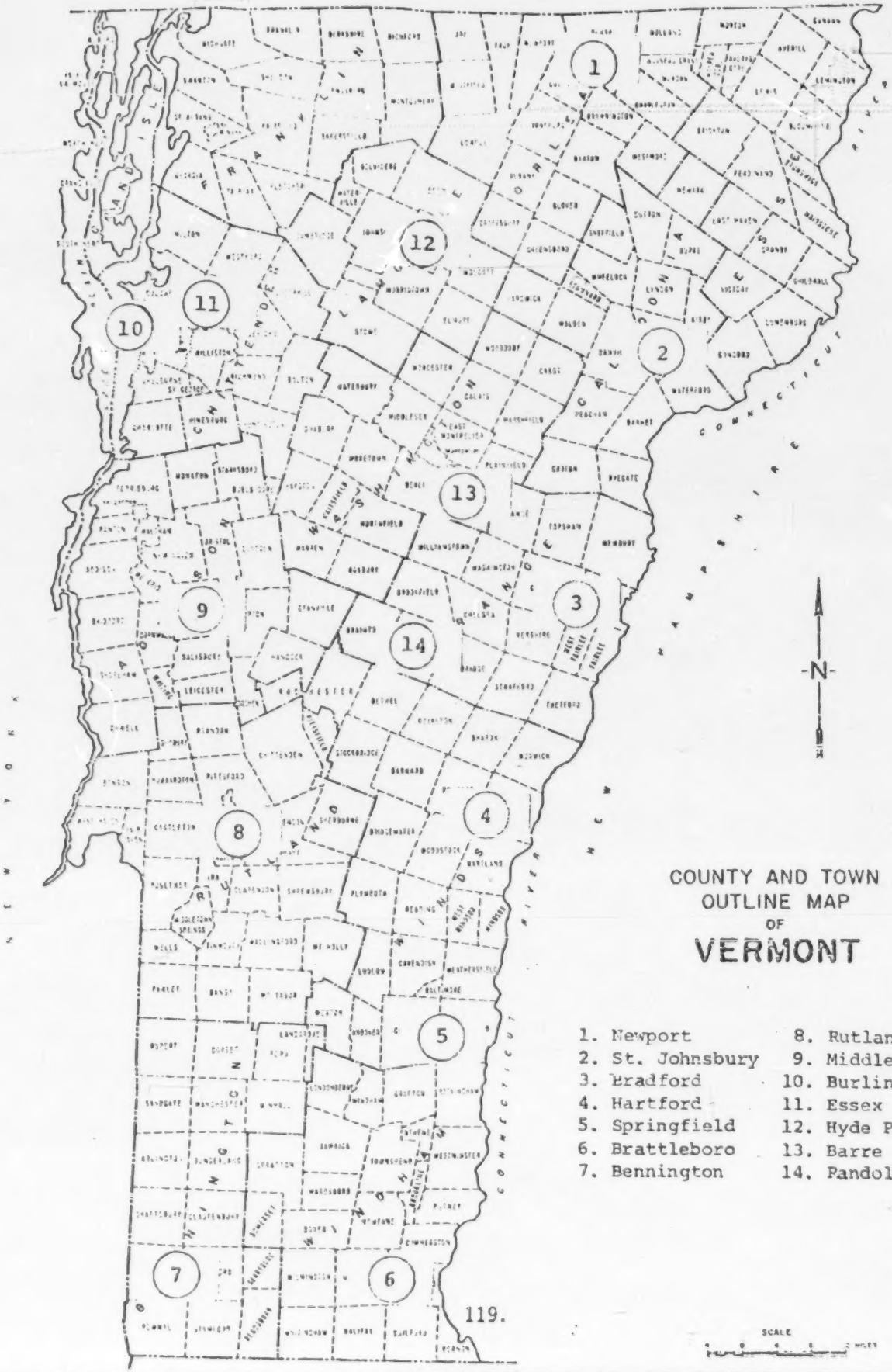
Occupational Aptitude Pattern Number	Pattern	GATB	NATB	% of Increase Over GATB
27	GKF	4	7	75
28	GFM	17	28	65
29	VQK	1	2	100
30	VNK	1	3	200
31	NSQ	0	4	400
32	NFM	0	5	500
33	NPQ	0	8	800
34	NSP	1	14	1300
35	NSF	2	14	600
36	NPM	1	16	1500
37	NSM	1	17	1600
38	NSK	5	23	360
39	NQK	7	29	314
40	NQM	7	32	357
41	SQK	8	32	300
42	SPM	13	33	154
43	SPF	16	32	100
44	SPK	12	24	100
45	SQF	25	36	44
46	SKM	16	25	56
47	SFM	16	27	69
48	SPM	40	62	55
49	PFM	17	30	76
50	PKM	10	12	20
51	PKM	20	27	35
52	PQM	36	51	42
53	PFM	16	19	188
54	PKF	14	18	29
55	PKM	34	41	21

Table 14 (Continued)

Occupational Aptitude Pattern Number	Pattern	GATB	NATB	% of Increase Over GATB
56	PFM	29	36	24
57	QKM	10	10	0
58	QKF	12	15	25
59	QFM	20	23	15
60	QKM	17	20	18
61	KFM	10	11	10
62	KFM	21	24	14

APPENDIX J

AREA VOCATIONAL CENTERS HOUSING DIVERSIFIED OCCUPATIONS PROGRAMS

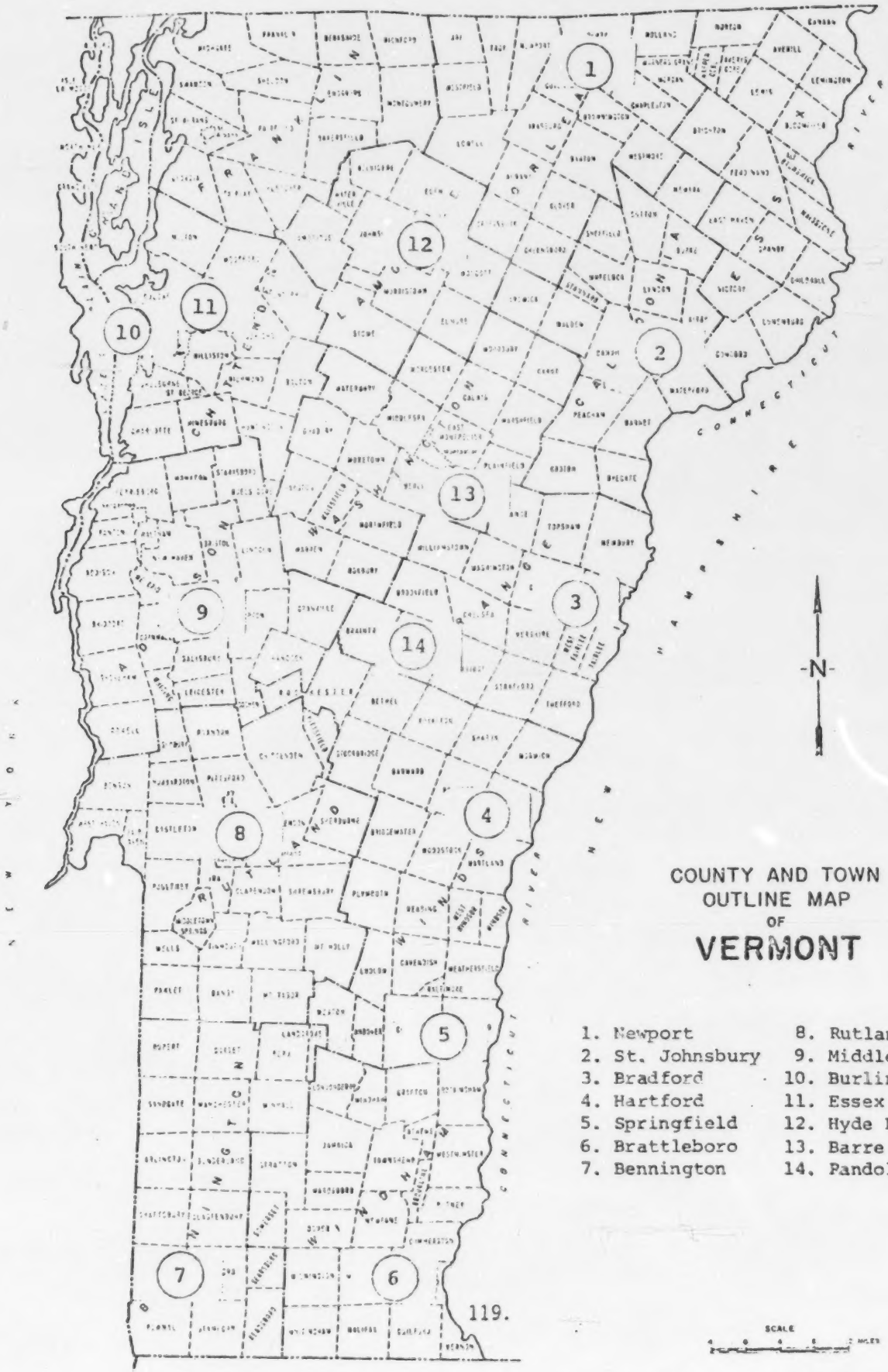


COUNTY AND TOWN
OUTLINE MAP
OF

VERMONT

1. Newport
2. St. Johnsbury
3. Bradford
4. Hartford
5. Springfield
6. Brattleboro
7. Bennington
8. Rutland
9. Middlebury
10. Burlington
11. Essex
12. Hyde Park
13. Barre
14. Pandolph

AREA VOCATIONAL CENTERS HOUSING DIVERSIFIED OCCUPATIONS PROGRAMS



COUNTY AND TOWN
OUTLINE MAP
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1. Newport
2. St. Johnsbury
3. Bradford
4. Hartford
5. Springfield
6. Brattleboro
7. Bennington
8. Rutland
9. Middlebury
10. Burlington
11. Essex
12. Hyde Park
13. Barre
14. Randolph

SAMPLE INDIVIDUAL APTITUDE PROFILE FOR THE GATB

Name: JONES, MARY J. (Last name) (First name) (Middle initial) Date 9-4-70

S*	S*

Adult ☑ B-1001 ☐
Grade 9 ☐ B-1002 ☑
Grade 10 ☐ Form ○A B C D

GATB
INDIVIDUAL APTITUDE PROFILE

Part B-1002	Part B-1001	Raw Score	G	V	N	S	P	Q	K	F	M
1	B	54						104			
2	D	25			82						
3	H	16	15			101					
4	J	26	63	111							
5	A	37					65				
6	I	8	19		14						
7	L	29					51				
8	K	71							103		
9	M	90								23	
10	N	103								79	
11	O	07								36	
12	P	34								69	
Aptitude Scores			98	111	96	101	116	108	103	105	102
1 SEm			6	6	6	8	9	9	7	12	11
Aptitude Scores ± 1 SEm			104	117	102	109	125	117	110	117	113

OAP NUMBERS*
*CIRCLE IN RED FOR GRADE H
CIRCLE IN BLACK FOR GRADE M
CROSS OUT FOR GRADE L

All	13	26	39	52
✗	14	27	40	53
✗	15	28	41	54
✗	16	29	42	55
✗	17	30	43	56
✗	18	✗	44	57
✗	19	32	45	58
✗	20	33	46	59
✗	21	34	47	60
9	22	35	48	61
10	23	36	49	62
11	24	37	50	
12	25	38	51	

SAMPLE INDIVIDUAL APTITUDE PROFILE FOR THE NATB

NAME Little, Yvonne DATE Jan. 29, 1971

Adult ☒ Grade 9 ☐ Grade 10 ☐

NONREADING APTITUDE TEST BATTERY
INDIVIDUAL APTITUDE PROFILE

S-* S-*

NATB TEST	RAW SCORE	G	V	N	S	P	Q	K	F	M
A	20	15	20							
B	40	33	26	28						
C	21			25						
D	24	17		15						
E	40					77				
F	15	29			97					
G	15					38				
H	41			44						
I	35						95			
GATB PART										
8	70							101		
9	109									57
10	59									45
11	33								55	
12	26								53	
Aptitude Scores		94	96	112	97	115	95	101	108	102
±1 SEm		7	6	9	8	9	9	7	12	11
Aptitude Scores ±1 SEm		101	102	121	105	124	104	108	120	113

OAP NUMBERS*

*CIRCLE IN RED FOR GRADE H
CIRCLE IN BLACK FOR GRADE M
CROSS OUT FOR GRADE L

NATB Test Record Card (back)

Note: Consider lighter circles as "RED" indicating grade "H".
Consider heavier circles as "BLACK" indicating grade "M".

APPENDIX M

OCCUPATIONAL APTITUDE PATTERNS

OAP–12

GATB NORMS

APTITUDES	CUTTING SCORES		
	Adult	*Grade 10*	*Grade 9*
S (Spatial Aptitude)	90	89	87
P (Form Perception)	85	81	76
M (Manual Dexterity)	85	79	76

		S#	APTITUDE SCORES								
			G	V	N	S	P	Q	K	F	M
						90	85				85
WTG p. 234	ARTISTIC RESTORATION, DECORATION AND RELATED WORK										
298.381	Decorator (any ind.) I										
WTG p. 271	INSPECTING & STOCK CHECKING										
379.381	Automobile Tester (gov. ser.)										
502.382	Fluoroscope Operator (aircraft mfg.; nonfer. metal alloys)										
609.382	Inspector, Magnetic (mach. shop)										
609.384	Comparator Operator (any ind.)										
827.387	Refrigerator Tester (refrigerat. equip.)										
WTG p. 312	CRAFTSMANSHIP AND RELATED WORK										
332.381	Wig Dresser (hairwork; per. ser.)										
339.381	Lady Attendant (per. ser.)										
518.381	Coremaker (found.)										
*633.281	Adding-Machine Serviceman (any ind.)	234				90	85		80		85
*633.281	Calculating-Machine Serviceman (any ind.)	234				90	85		80		85
*633.281	Cash-Register Serviceman (any ind.)	234				90	85		80		85
*633.281	Duplicating-Machine Serviceman (any ind.)	234				90	85		80		85
*633.281	Office-Machine Serviceman (any ind.)	234				90	85		80		85
*633.281	Typewriter Serviceman (any ind.)	234				90	85		80		85
*693.381	Model Maker (aircraft mfg.) I	448				90	75				90
712.281	Medical-Apparatus Model Maker (inst. & app.)										
*712.381	Dental-Laboratory Technician (medical ser.)	285				80	80		80		85
712.381	Molder, Bench (dental equip.)										
*772.281	Glass Blower, Laboratory Apparatus (glass prod.; inst. & app.)	345				95	95				95
**804.281	Sheet-Metal Worker (any ind.)	82R				90		80	75		95
*807.381	Automobile-Body Repairman (auto. ser.)	313				85	90				90

OAP–12—Continued

GATB NORMS

APTITUDES	CUTTING SCORES		
	Adult	*Grade 10*	*Grade 9*
S (Spatial Aptitude)	90	89	87
P (Form Perception)	85	81	76
M (Manual Dexterity)	85	79	76

		OAP	APTITUDE SCORES								
			G	V	N	S	P	Q	K	F	M
						90	85				85
WTG p. 319 PRECISION WORKING											
575.781	Glass Blower (glass mfg.)										
638.781	Machine Assembler (mach. mfg.)										
700.781	Hammersmith (silverware)										
705.781	Lapper, Hand, Tool (mach. shop)										
780.781	Luggage Maker (leather prod.)										
844.781	Concrete-Stone Finisher (conc. prod.)										
WTG p. 322 MANIPULATING											
*706.884	Power-Lawn-Mower Assembler (agric. equip.)	141	100			85	85				80
*930.884	Rotary-Driller Helper (petrol. production)	328				85	95				85
WTG p. 430 SET-UP AND/OR ALL-ROUND MACHINE OPERATING											
015.380	Radioisotope-Production Operator (chem.)										
500.380	Plater (electroplating)										
501.380	Flame-Hardening Machine Set-Up Man (heat treat.)										
*601.280	Turret-Lathe Set-Up Operator, Tool (mach. shop)	33	80			80	85				80
*619.380	Metal-Fabricator (any ind.) I	235				90	70			70	85
619.380	Multi-Operation-Forming-Machine Set-Up Man (any ind.)										
†675.380	Precision-Lens Grinder (optical goods)	534				95	80				75
695.280	Loading-Machine Tool-Setter (ammunition)										
809.380	Balancing-Machine Set-Up Man (any ind.)										
813.380	Welder Set-Up Man, Resistance Machine (welding)										
814.380	Brazing-Machine Set-Up Man (welding)										
WTG p. 433 SET-UP AND ADJUSTMENT											
617.780	Set-Up Man (iron & steel: ore dress.; smelt. & refin.)										

APPENDIX N

Product Moment Correlation Coefficients Between GATB and NATB Aptitude Scores and I.Q. Sub Scores and Reading Grade Levels

	PIQ	FSIQ	VIQ	NG	NV	NN	NS	NP	NQ	GG	GV	GN	GS	GP	GQ	GK	GF	GM
Reading	.18	.33	.43	.37	.36	.21	.07	.16	.09	.37	.35	.37	.10	.11	.09	.20	.16	.03
IQ		.82	.36	.56	.22	.49	.54	.53	.12	.39	.09	.26	.54	.47	.12	.16	.40	.42
FSIQ			.80	.51	.24	.49	.41	.38	.12	.36	.16	.38	.36	.40	.11	.23	.29	.38
VIQ				.44	.28	.33	.20	.07	.13	.35	.18	.38	.21	.06	.06	.17	.13	.21
NG						.62	.74	.43	.15	.43	.17	.42	.58	.35	.21	.09	.28	.26
NV						.38	.32	.37	.14	.28	.15	.26	.24	.36	.16	.08	.26	.12
NN							.48	.55	.40	.33	.16	.44	.40	.45	.35	.29	.41	.38
NS								.49	.10	.33	.01	.30	.59	.39	.17	.88	.28	.32
NP									.53	.24	.03	.33	.38	.74	.47	.39	.50	.55
NQ										.36	.31	.33	.19	.41	.51	.32	.26	.23
GG											.83	.56	.51	.27	.25	.18	.24	.08
GV												.27	.19	.10	.13	.10	.09	.07
GN													.34	.33	.40	.36	.26	.14
GS														.38	.17	.09	.33	.29
GP															.46	.43	.52	.50
GQ																.44	.26	.26
GK																	.46	.44
GF																		.64
GM																		

1. All coefficients have been multiplied by 100 to eliminate percentage points
2. N=99 Students having reading grade levels
3. N=94 Students having PIQ and VIQ scores
4. N=140 Students having NATB and GATB aptitude scores

APPENDIX O

SAMPLE STUDENT DATA CARD

Student's Name Smith (Last) William (First) D (M.I.) Sex - M X F__

Student's Address 6 Jones Drive (Street) Burlington (City or Town)

Date of Birth 7 (Month) 16 (Day) 56 (Year) Right Handed__ Left Handed V

School Attending Burlington High Class Grade 9__ 10__ 11 V 12__

Briefly describe any handicapping condition (other than retardation) which might affect the student's score on the tests. none

Do not fill in information below this line - data collected by the project staff.

Individual I.Q. Test WISC (Name of Test) Date Administered 3-8-73

V.I.Q. 66 P.I.Q. 71 F.S.I.Q. 69

Reading grade equivalent 3.2 date of testing 3-6-74

Number of OAP's from GATB 3

Number of OAP's from NATB 11